CHAPTER 3 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 INTRODUCTION

This chapter describes the current condition of the resources as they relate to the significant issues. These issues represent components of the environment that would affect, or that could be affected by the alternatives if implemented.

In order to understand the contribution of past actions to the cumulative effects of the Proposed Action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the Proposed Action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions. Additionally, focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. By looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. Third, public scoping for this project did not identify any public interest or need for detailed information on individual past actions. Finally, the Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions."

The cumulative effects analysis in this EIS is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which state, in part:

"CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives would add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR 1508.7)"

For these reasons, the analysis of past actions in this document is based on current environmental conditions.

3.2 CUMULATIVE EFFECT CONSIDERATIONS

3.2-A – PAST ACTIVITIES AND EVENTS

Past timber harvests need to be described in suitable detail (time, place, type and scale) including a sufficiently detailed explanation of the effects of different harvest methods in order to promote an informed assessment by the public and agency personnel. This information is included in Appendix C.

Past activities that have contributed to the current baseline conditions within the project area today, and may be included in the cumulative effects analysis. It is important to keep in mind that the cumulative effects analysis areas for the various resources are not always identical. For instance, an aquatic environmental analysis might be based on a watershed boundary, while the sensitive plants analysis is tied to a particular set of habitat types and topographic features.

3.2-B – CURRENT MANAGEMENT AND ONGOING ACTIVITIES

Even if no activities were being proposed under the Big Grizzly project, certain management would continue in the area because of past decisions and current land management policies. Such activities that may be considered as appropriate in the cumulative effects analysis include:

- Personal use firewood gathering consisting of salvage of individual dead trees by the public under a Firewood Permit system.
- Mining claim activities.
- Various types of recreation including hiking, motorized recreation on designated trails, horseback riding, fishing, camping, driving, hunting, and dispersed camping.
- Activities on private lands within the assessment area such as forest lands management, and mining claim activities.
- Standard levels of maintenance on Forest Service roads and trails.
- Suppression of human-caused fire starts and wildfires under the jurisdiction of the U.S. Forest Service or the California Department of Forestry and Fire Protection.

Use of Best Management Practices

Best Management Practices (BMPs) are measures certified by the State Water Quality Board and approved by the Environmental Protection Agency (EPA) as the most effective way of protecting water quality from impacts stemming from non-point sources of pollution. These practices have been applied in timber sales and road construction projects over the last 20 years and have been found to be effective in protecting water quality within the Eldorado National Forest. Specifically, effective application of the R-5 U.S. Forest Service BMPs has been found to maintain water quality that is in conformance with the Water Quality Objectives for the Central Valley Regional Water Quality Control Board. The Region 5 Forest Service BMPs have been monitored and modified since their original implementation in 1979 to make them more effective. The Forest monitors the implementation and effectiveness of BMPs on randomly selected projects each year. The full list of BMPs is available for review in USDA Forest Service. 2000. Water Quality Management for National Forest System Lands in California – Best Management Practices. Pacific Southwest Region, Vallejo, California. A discussion on implementation of BMPs for this project is provided in Appendix B.

Road Construction Methods

Forest Service BMPs currently incorporated into road construction and reconstruction activities on the Eldorado National Forest include:
Road surfacing (road rocking, chip sealing, etc..) is included in reconstruction activities to not only provide better traffic usage; but also to prevent and control erosion from the road surface
Road drainage controls are being incorporated into designs that are intended to:
Reduce the erosive flows in ditches by providing frequent cross-drains to relieve ditch flows;
Avoid water movement down the road by dispersing the drainage quickly by crowning or outsloping the road surface;
Disperse drainage water (that often carries sediment) onto stable forested slopes before ditches discharge into waterways;

Ensure new and existing stream crossings safely pass extreme events when constructed or reconstructed (i.e. 100-year flood event).

New roads are designed to take advantage of the non-uniformities of the slopes they cross by using "rolling grades" and grade breaks to prevent the potential for accumulations of water or excess ditch flows that otherwise would have destabilized the road bed or caused surface erosion in the past.

Designers and planners develop road networks that avoid highly erosive or unstable slopes utilizing the land systems inventory, and the knowledge and experience of hydrologists, soil scientists, and geotechnical engineers.

Road/creek crossings are being located at more stable sites and crossings designs are now considering water quality as a primary design criteria rather than criteria that primarily are directed at cost and traffic efficiency. Roads are being located well away from streams and their riparian areas wherever practical; and the number of crossing sites is minimized. These efforts are in stark contrast to some past road locations that sometimes resulted in chronic sources of sediments.

In the past, when a road's utility ended, the road was simply abandoned. These abandoned roads have been a substantial water quality and slope stability issue as they have deteriorated, especially without maintenance. Current practice is to restore key abandoned or no longer useful roads to a "hydrologically neutral" condition.

Timber Management

Modern timber harvest prescriptions and design emphasize desired conditions of the forest after harvest. This usually results in the retention of trees in a post-harvest stand addressing objectives that may include wildlife habitat, watershed conditions, hazardous fuels, visual quality, soil productivity, forest health and others.

Some examples where timber production and resource objectives can be achieved simultaneously are:

- Reducing tree densities to decrease bark beetle hazard, thereby prolonging the development of the forest and maintaining tree cover;
- Managing tree canopies to limit fire spread from the forest floor to the tree crowns; and
- Increasing the amount of ponderosa pine and sugar pine, which generally are insect and disease, and drought resistant and are long-lived.

Other elements of modern harvest prescriptions that address specific resource objectives include the following:

- Retention of snags for cavity nesters;
- Retention of down wood for soil nutrition and wildlife habitat;
- Maintaining sediment filtering vegetation near riparian areas; and
- Maintaining vegetation diversity through hardwood retention and protection of rare plants.

Logging Systems for Tree Removal

Increased environmental awareness has led to improvements in logging systems that are used to remove trees from the forest. Today's logging systems recognize and reduce the threat of environmental harm in a number of ways. Tractor logging generally occurs on slopes 35% or less, and is limited to designated locations, reducing soil impacts. A number of Best Management Practices and Forest Plan Standards and Guidelines guide the development of the least impacting design possible. Monitoring during and after the sale is completed provides a valuable feedback loop that identifies and corrects problems should they occur.

Conclusions Regarding Past Activities

For the above stated reasons, changes in road construction/reconstruction and maintenance practices; implementation of BMPs, and changes in harvest practices and objectives, a review of past projects cannot be used to predict the effects of the proposed activities. However, the incremental effects of the Proposed Action when added to the effects of past, present, and reasonably foreseeable actions are displayed and provide a complete assessment of cumulative effects.

When considering the effects of past land management activities, it is important to remember

that ecosystem components are resilient and over time can recover from both natural disturbance and human-caused changes. These past events (harvest, road construction, fire suppression, mining, and grazing) have affected the ecosystem in the ways discussed in the following pages. Past activities on privately owned lands, as well as National Forest System lands, were considered in the analysis for the EIS and the effects of those activities are documented in this chapter.

3.2-C – REASONABLY FORESEEABLE ACTIVITIES

The following reasonably foreseeable actions and management are considered in the cumulative effects analysis in this chapter, as appropriate for each resource analyzed in this EIS. The cumulative effects area for each resource is described in this Chapter.

- Management of Noxious Weeds – Weed Eradication and Control on the Eldorado National Forest is intended to direct priorities for treatment of noxious weeds across the Forest with a variety of treatment methods including hand treatments and herbicide treatments. The Proposed Action is still currently being developed.
- Timber harvest on private lands – Since 2008 no known timber harvest plans within the vicinity of the Big Grizzly project have been approved by the state of California. Neighboring land owners have begun to prepare a THP planning for a fuels reduction project that would boarder roads in Sections 21, 23, and 25 T 13N R12E, and Sections 17, 19, 21 and 22 T13N R13E. This document is expected to be submitted for approval in 2011.
- Blacksmith Flat Fuels Reduction Project – This project is a mechanical fuels and forest health treatment project planned for implementation in 2013 north of the Big Grizzly project in general forest and old forest emphasis area. This project is still in the early planning stage.
- Hartless Ridge Fuels Reduction Project – This project is a 929 acre mechanical thinning and fuels reduction project in defense, threat, general forest, and old forest emphasis areas south of the Big Grizzly project.

3.3 WILDFIRE BEHAVIOR

EXISTING CONDITIONS

Fire Severity and Return Interval

Fire has been an ecological force in the Sierra Nevada since the retreat of the Tioga glacier more than 10,000 years ago. Flammable fuels, abundant ignition sources, and hot, dry summers combine to produce conditions conducive to an active fire role. This role has varied over the millennia as climate has changed, however fire continues to shape vegetation and other ecosystem components (Sugihara, et al., 2006).
When the role of fire is altered or removed there can be significant changes in the ecosystem. Fire has burned in every ecosystem and virtually every square meter of the mixed conifer forest of the Sierra Nevada. Fire maintains ponderosa pine and sugar pine throughout their range, killing ever-invading shade tolerant species. In its natural role, fire is not a disturbance that impacts ecosystems; rather it is an ecological process that is as much a part of the environment as precipitation, wind, flooding, soil development, erosion, predation, herbivory, carbon and nutrient cycling, and energy flow. Fire resets vegetation trajectories, sets up and maintains a dynamic mosaic of different vegetation structures and compositions, and reduces fuel accumulations. Humans have often disrupted these processes, and the result can be that fire behavior and effects are outside of their range of natural variation. At this point, fire is considered an exogenous disturbance factor (Sugihara et. al, 2006).

In the following discussion, "severity" refers to the amount of damage a fire causes to stands of timber and "return interval" refers to how often a particular type of fire occurs. Photos and definitions summarize the types of fires that occur in these forested ecosystems.

Mixed Severity fires - fires that kill more than 10%, but less than 90% of the dominant tree canopy. Mixed severity fires are commonly patchy, irregular burns, producing a mosaic of different burn severities. Return intervals for mixed severity fires may be quite variable.

FIGURE 15 PHOTOGRAPH OF MIXED FIRE SEVERITY RESULTS ON PORTION OF THE 2003 POWER FIRE ON THE AMADOR RANGER DISTRICT.

Non-lethal fires- fires that kill 10% or less of the dominant tree canopy. These are commonly low-severity surface and understory fires, with short return intervals of less than 25 years.

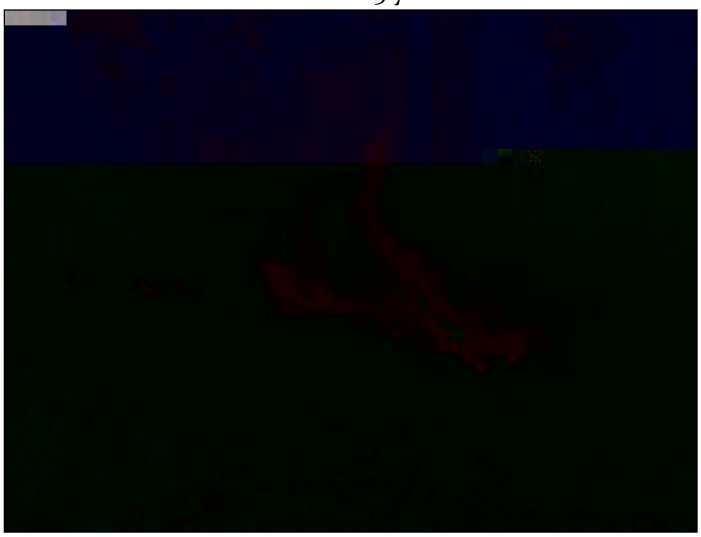

FIGURE 16 PHOTOGRAPH OF LOW SEVERITY SURFACE FIRE FROM PRESCRIBE BURN ON THE GEORGETOWN RANGER DISTRICT.

Lethal fires- fires that kill 90% or more of the dominant tree canopy are termed stand replacing fires. Lethal fires frequently burn with high severity and are commonly crown fires.

FIGURE 17 PHOTOGRAPH OF STAND REPLACING FIRE FROM THE 2007 ANGORA FIRE ON THE LAKE TAHOE BASIN MANAGEMENT UNIT.

FIGURE 18 PHOTOGRAPH OF EFFECTS OF STAND REPLACING FIRE FROM 2003 FRED'S FIRE ON THE PLACERVILLE RANGER DISTRICT

The lower-montane forest zone best represents the vegetation type within the Big Grizzly project. Interspersed within the forests are chaparral stands, riparian forests, and meadows and seeps. Historically, fires within this zone had a frequent fire return interval. All sites in the lower-montane zone experienced fire frequently enough to reduce fuel accumulations and vegetation density, and, as a result, these fires were primarily of low to moderate intensity and severity (Sugihara et. al, 2006).

Current fuel conditions do not compare to historical Sierra Nevada fire ecology for the lower montane forest zone. A horizontally continuous fuel condition enables a fire to easily travel across the landscape. Moreover, vertical arrangement provides fire the ability to reach the canopy of large diameter trees.

With the absence of fire throughout the landscape and previous land management activities, an unnatural accumulation of hazardous fuel conditions exist. Surface dead fuel loading that has naturally accumulated overtime in the absence of fire, as well as slash produced from previous land management activities have contributed to hazardous fuel loadings while dense pockets of small diameter trees provide a "ladder effect" into the upper canopy structure of large diameter trees.

Approximately 1,100 acres of the Big Grizzly project are located in young ponderosa pine plantations. Within these stands tree heights range from 4 to 20 feet. Brush is intermixed between trees and is in contact with the canopy, averaging heights of 6 feet. Both horizontal continuity and vertical arrangement of fuels provide the opportunity for establishment of a wildland fire under current conditions.

A fire occurring within the Big Grizzly project area under existing conditions could easily transition from a surface fire into a passive or active crown fire. Current forest structure within the project area promotes the potential for a wildland fire to become difficult for fire suppression resources to control as well as causing potential negative impacts to wildlife, watershed and heritage resources.

The Big Grizzly Fuels Reduction project area is composed of relatively broad ridges along with deep drainages running generally southwest to northeast. The typical wind patterns in this area during fire season are south to southwest. The combination of the topography and the typical wind direction in this area lead to the potential of large fire growth given the current surface, ladder, and aerial fuels. A particularly hazardous situation would be a fire start in or near the bottom of any drainage in or around the project area. The characteristic surface, ladder and aerial fuels on the north slopes in the project area are relatively heavy with a high potential for rapid spread. The more southern aspects in the project area have somewhat less vegetation, however, the fuels are still contiguous and the crown fire potential remains high. Spotting potential is also high given the heavy contiguous vegetation on or near the ridges and fuel beds on the drainage slopes on virtually every aspect. This is evidenced by two relatively recent large fires in the vicinity of the project area, the Star Fire in 2001 and the Ralston Fire in 2005. Both of these fires exhibited long range spotting and rapid fire growth. It must be noted however, that in the aftermath of the Ralston Fire, the resource damage was limited by the lower surface fuels on the slope above the South Fork of the Middle Fork of the American River. This would most likely not be the case in the areas around the Big Grizzly project area.

A fire occurring within the project area would be dominated by topographic conditions including slope, aspect and elevation. Within the Big Grizzly project area slopes typical are greater than 35%. Slope contributes to increased fire behavior by preheating fuels ahead of a fire making fuels readily available to burn more rapidly.

Aspect influences fire behavior in several ways. Aspect contributes to fuel temperature and fuel shading. For example, a fire ignition occurring at 9:00 am on a west aspect would react differently at that time then on an east aspect because the east aspect would have lower fuel moistures at that time due to solar heating. As the sun continues to rise the south and west aspects are affected by solar heating. Air and fuel temperatures begin to increase causing a decrease in fuel moisture and relative humidity. Typically, the "hottest" weather conditions (high temperature, low relative humidity, low fuel moisture), occur between 2:00 pm and 4:00 pm. During the "hottest" period south and west aspects are most susceptible to fire ignition and spread. The Big Grizzly Project is composed mainly of south and west aspects.

Weather factors into determining the ignition, fire behavior, and severity of a wildland fire. Temperature, precipitation, and humidity determine the availability of fuel to ignite and sustain combustion. A direct relationship between fuel moisture (amount of moisture within dead fuel) and relative humidity exists; as relative humidity decreases, fuel moisture decreases. Wind patterns are normally slope driven with diurnal wind patterns (upslope/up-canyon during daytime hours, and down slope/down-canyon during nighttime hours). Other wind patterns which occur with the passage of frontal

systems are north and east wind events. North winds, when unaccompanied by precipitation generally decrease relative humidity and fuel moisture conditions resulting in potential for large fire events to occur. The 2004 Fred's fire and Power fire (both occurring on the Eldorado National Forest) were the result of east winds and exhibited extreme fire behavior, influencing spread rate, flame length, fireline intensity and crown fire potential. On the Eldorado National Forest, traditional fire season occurs May through October; at which time weather conditions are typically equal to or exceed the potential for extreme fire behavior.

Major drainages include the Rubicon River drainage, Wallace Canyon, and Big Grizzly Canyon, which run in a southwest to northeast direction. Diurnal slope driven wind patterns in combination with the drainage and canyon positioning create an alignment of wind and slope greatly increasing potential fire size.

Fires and Firefighting Efforts

Firefighting effectiveness increased in the 1940s and 1950s with additional fire suppression dollars, which allowed for increased use of trained firefighting crews, smoke jumpers, airplanes, helicopters, and bulldozers. The basic tasks of building fireline and "mopping up" after a fire is controlled have not changed a great deal over time. Continuous studies of the science of fire and application of new technologies benefit land managers and incident management teams when they are establishing strategies and objectives during both wildfires and prescribed burning projects.

With the current condition of fuels, topography, and weather, fire managers are hesitant to commit fire resources (engine companies or hand crews) along the ridges if there is active fire underneath them in the drainages and no reasonable way to access the fires edge as would be the case in almost all of the Rubicon River drainage, Roost Canyon and Little Grizzly Canyon on the west end of the project area and Wallace Canyon in the northern portion. The amount, type, and configuration of the fuels within the project area contribute greatly to the potential flame lengths, fireline intensity, rates of spread and crown fire activity. The conditions within the proposed treatment units currently are such that direct attack on a fire with personnel and hand tools or heavy equipment (dozers) would not be advised due to the potential for extreme fire behavior. This potential for extreme fire behavior also contributes greatly to the potential for severe resource damage, both with tree mortality and detrimental soil heating. Should this occur within the existing California Spotted Owl Home Range Core Area (HRCA) the potential exists for significant destruction of owl habitat.

A concern for fire managers dealing with managing a large fire in the Big Grizzly project area is the current lack of either existing adequate safety zones or areas having the potential for quick construction adequate of safety zones. Safety zones are areas cleared of flammable materials used for escape in the event a fire line is outflanked or if a spot fire causes fuels outside of a control line to render the line unsafe. Safety zone sizes vary by terrain and fire behavior and are subjective judgments of the fire managers on the scene.

In the event of a large fire in this area, firefighting efforts would

would likely take greater than one hour for the first resource to arrive on scene due to the road conditions which limit travel speed. Fires located either within or next to proposed treatment units would likely remain small for a longer time compared to untreated areas. An example of this occurred within a treated project area on the Georgetown Ranger District in 2008. The Bear Fire, a lightning caused event within a treated unit of the Flat Rat Fuels Reduction Project during the 2008 lightning storms. These same storms led to the American River Fire Complex on the American River of the Tahoe National Forest and many other destructive fires throughout northern California. The Bear Fire occurred within a unit that had been treated 2 years prior to the fire event. The fire stayed at approximately ¼ acre for over 2 hours until resources

As a result of successful fire suppression, fire has been largely absent from the project area. Since 1971 forty-nine fire starts have been recorded in the project area of which 3 grew larger than five acres.

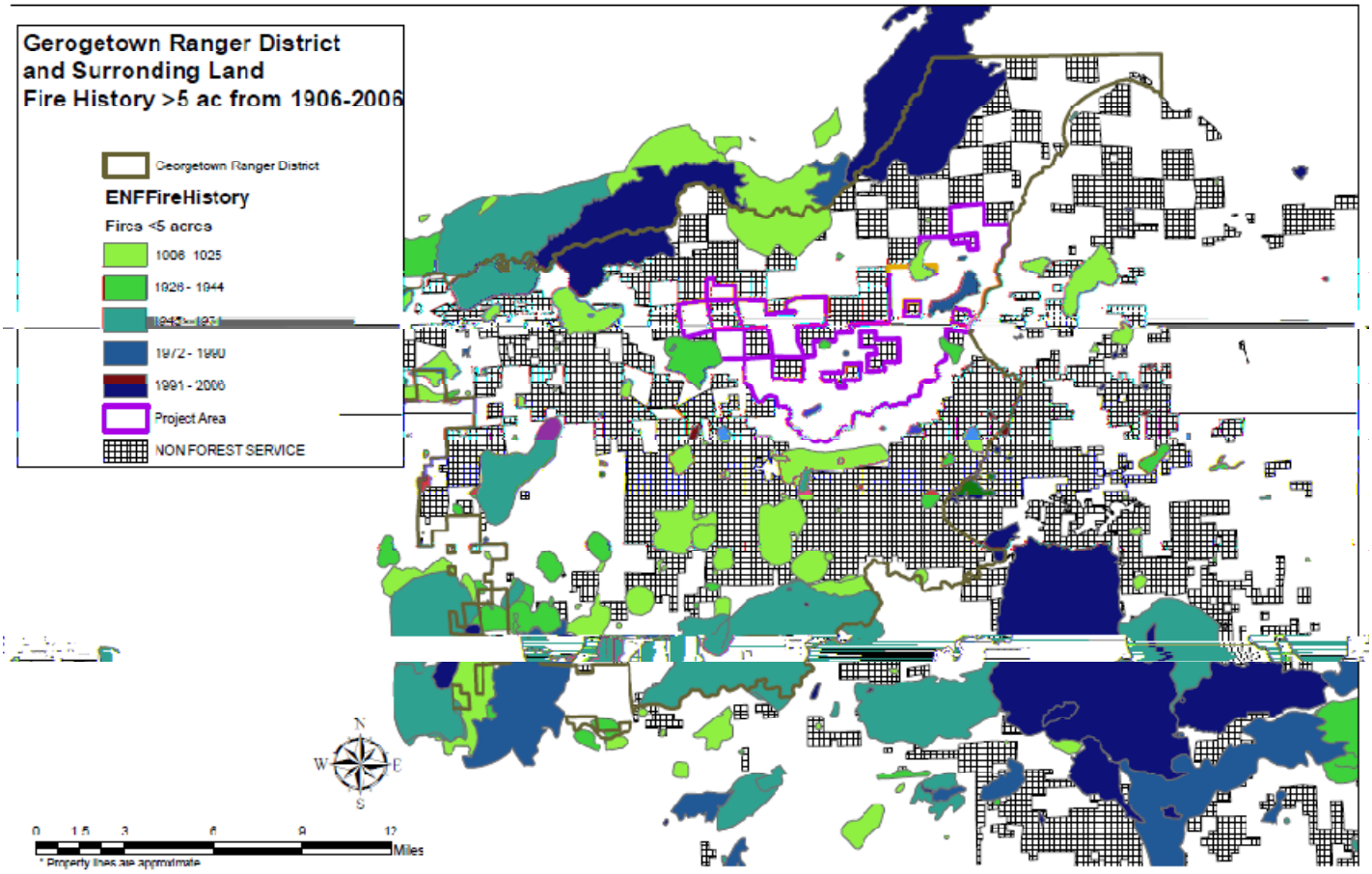

FIGURE 19 MAP OF FIRES GREATER THAN 5 ACRES IN THE VICINITY OF THE GEORGETOWN RANGER DISTRICT, AND IN RELATION TO THE PROJECT AREA

FIRE BEHAVIOR MODELING

Alternatives discussed below would be measured by how well they meet Forest Plan goals (SNFPA 2004 ROD page 34). This would be measured in terms of (specific standards and guidelines may be found in the SNFPA 2004 ROD pages 49-50):

- Spatial pattern of treatments produces reduced rate of fire spread and fire intensity at the head of the fire.
- Flame lengths - 4 foot is generally considered the upper limit for direct action taken by hand crews and 6 foot by mechanized equipment (dozers). Flame lengths in excess of these limits usually results in indirect action taken to contain the fire.
- Fire rates of spread - In number of chains per hour (66 feet/hour).
- Fireline intensity - Fireline intensity is the amount of heat released at the flaming front of a fire expressed in British thermal units per foot per second (btu/ft/sec). Intensities in excess of 100 btu/ft/sec are generally considered too hot for direct action by personnel. Fireline intensities greater than 500 btu/ft/sec are considered too hot for direct action by mechanized equipment.
- Crown Fire Behavior - Crown fire behavior can be described in four ways. The first is a surface fire, which burns only the fuels at or near the surface without torching the trees above. This is the desired condition. The second type is the passive crown fire, which torches out individual trees as the surface fuels burning under them provide the convective heat to ignite the aerial fuels. The

third is the active crown fire in which the fire is spread from tree to tree in conjunction with the convective heat of the surface fuels burning under them. The fourth is the running crown fire. This is a very rare occurrence in which the fire is spread from tree to tree independent of the burning surface fuels. This type of crown fire requires extreme weather conditions and contiguous heavy tree canopy, and is not modeled.

Treatment unit effectiveness across the landscape during 90th percentile weather conditions was modeled using FARSITE (Fire Area Simulator) (version 4.1). FARSITE is a two-dimensional program for spatially and temporally simulating the spread and behavior of fires under heterogeneous conditions. FARSITE incorporates existing fire behavior models of surface fire spread (Albini 1976, Rothermel 1972), crown fire spread (Rothermel 1991, VanWagner 1977, 1993), spotting (Albini 1979), point source fire acceleration (Forestry Canada Fire Danger Group 1992), and fuel moisture (Nelson 2000) with spatial information on fuels, weather, and topography(Stratton, 2006).

With the FARSITE model, a simulated fire is recorded in terms of fire perimeter, fireline intensity, flame length, rate of spread, and crown fire activity at any given point using the weather and wind data for the time it reaches that point. Caution should be exercised when interpreting the outputs of this program as the result of this is a diurnal variation reflected in the fire behavior results. In other words, if the flaming front of the fire reaches a point at 0400 hrs the results are different than if it reached the same point at 1400 hrs. This method also reflects the "shadow" effect after a fire burns through a treated area and slowly regains intensity in the untreated fuels on the "lee" side of the treated area, giving an indication of the potential "treatment multiplier" effect of overlapping SPLATS. Ebert (2009) provides the assumptions and limitations of the FARSITE modeling program.

Utilizing FARSITE Area Simulator, Fuels data from the Eldorado National Forest GIS Database, and 90th percentile weather conditions derived from National Fire Danger Rating System and BALD Mountain Remote Automated Weather Station (RAWS), the Big Grizzly project can be modeled at the landscape level to evaluate the potential fire behavior effects and perimeter growth of each alternative. A total of 5 ignition points (4 ignition points selected outside of the proposed treatments and 1 ignition point within the treatment area) were selected to evaluate the potential effects the Big Grizzly Fuels Reduction project.

Potential tree mortality in the event of a wildland fire during 90th percentile weather conditions was modeled under both the current condition and probable post treatment conditions for each alternative.

Tree mortality is computed using the algorithm developed by Ryan and Reinhardt (1988). It uses bark thickness and percent of crown volume scorched as predictive variables. This method implicitly assumes that variations in fire caused tree mortality in trees of different species and sizes can be accounted for primarily by differences in bark thickness and proportion of crown killed. This assumption, while undoubtedly simplistic, allows us to predict mortality for any trees as long as we can estimate bark thickness, tree height, crown ratio and scorch height.

Using flame length as the variable for predicting mortality, scorch height is computed using Van Wagner's (1973) scorch height model, assuming a temperature of 77 degrees F and a midflame wind speed of 0 mph. These values seem conservative for many situations since computed scorch height varies little with temperature between 40 and 80 degrees F, and wind speeds between 0 and 10 mph. These ranges encompass many prescribed fire situations. At higher wind speeds typical of many wildfires, computed scorch heights actually decrease for a given flame length, so predicted scorch height and consequently, tree mortality would be over predicted. Van Wagner's scorch height model was developed from stands of red pine on flat ground; it can be expected to perform poorly on steep slopes, at ridge tops, and in stands with large openings in the canopy.

The data from which the tree mortality algorithm was developed was limited to western conifers greater than 5 inches dbh underburned with prescribed fire. The predictions should apply reasonably well to wildfires. Some post fire insect damage is implicitly included in these predictions, as trees damaged by insects after burning were not excluded from the data. Major post fire insect attacks are not modeled however. Root damage is not explicitly modeled,

although it may be correlated with cambial damage in many cases.

Fire behavior Analysis is performed using the FlamMap fire behavior model to describe effects in terms of fireline intensity, flame length, rate of spread, and crown fire activity. With the FlamMap program, every point within the project units is analyzed for the given parameters with the same wind and weather conditions (and therefore the same fuel moisture conditions). The FlamMap program does not "grow" a fire like the FARSITE model does, therefore there is no fire perimeter. The advantage in this is that we can compare the expected fire behavior between different treatments under the same environmental conditions. The disadvantage is that this method does not reflect any "shadow" effect after a fire burns through a treated area. Assumptions and additional limitations of the FlamMap program are provided in Ebert (2009).

Fire behavior fuel models are used as input to the Rothermel (1972) fire spread model, which is used in a variety of fire behavior modeling systems including FlamMap. The 2005 set of standard fire behavior fuel models were used in the Big Grizzly Fuels Analysis. Parameters of the fuel models are described in Ebert (2009). In the fuel models used, all fuel models with an herbaceous component are dynamic. In a dynamic fuel model, live herbaceous load is transferred to dead as a function of the live herbaceous moisture content.

EFFECTS

ALTERNATIVE 2 (NO ACTION)

Fuel conditions within the project area would continue to naturally accumulate, out pacing natural decomposition rates, and increasing the amount of hazardous fuel loading already available from previous activities such as fire suppression, domesticated live-stock grazing, and past logging activities. In the event of a wildland fire within the Rubicon drainage and Big Grizzly Canyon, ability to contain/suppress a fire would continue to be difficult due to the current condition of forest fuels. Critical holding and containment points would require large numbers of fire personnel and equipment to establish control lines or prepare for burning and holding operations.

The modeled data of the current condition of the Big Grizzly Fuels Reduction project show mortality rates > 90% for all species of trees (< 12" dbh). Black Oak exhibited the greatest variation between the proposed and current condition across all size classes with current modeled mortality rates greater than 95%. One would expect increased mortality within the larger diameter trees under current conditions. While the graphs do not exhibit this condition, high surface fuel loads with fireline intensities greater than 500 btu/ft/sec would damage many of the larger diameter tree root systems leading to mortality in the larger diameter trees. The roots would essentially be "cooked" due to the high intensities and residence burn time in the surface and duff fuel layer. Moreover, with the current condition of horizontally continuous fuels as well as vertical arrangement of the forest canopy, the ability of fire to climb into the canopy structure, would occur under current conditions as can be seen from the FlamMap fire modeling; under current conditions both passive and active crown fire as well as fireline intensities greater than 500 btu/ft/sec would occur on 60% of the area.

During 90th percentile weather conditions, over 60% (3,504 acres) of the proposed treatment area have the potential to exhibit Flame Lengths greater than 6 feet. Twenty percent (1228 acres) of the proposed treatment units would produce rates of spread greater than 20 chains per hour with 220 acres of that producing rates of spread greater than 40 chains per hour. Sixty-one percent (3,513 acres) of the treatment unit area could produce fireline intensities greater than 100 btu/ft/sec with 97% of those acre (3,402 acres) producing fireline intensities greater than 500 btu/ft/sec. Sixty-two percent (3,533 acres) of the area within project units have the potential to burn as either a passive or active crown fire in their current condition.

Cumulative Effects for Alternative 2

Continued accumulation of fuel without treatment would add to the cumulative effects from fire suppression and historic activities in the project area, increasing potential wildfire behavior and severity.

ALTERNATIVE 1 (PROPOSED ACTION)

Alternative 1 (Proposed Action) focuses on treating surface fuels, thinning from below to reduce aerial fuel ladders, improving stand resilience by retaining large diameter trees, and promoting a vegetation

mosaic with the use of prescribed fire to maintain fire resiliency. Stephens and others (2009) discuss treatment effectiveness of mechanical only, prescribed fire, and a combination mechanical and prescribed fire treatments. These results highlight the effectiveness of reducing surface fuels, thinning from below, and retaining the larger dominant and co-dominant trees in residual stands for reducing fire severity and increasing forest resilience (Agee & Skinner, 2005).

Proposed treatment units are located in strategic topographical locations. Fuel reduction treatment units located on slopes would potentially buffer the ridge top treatments from spotting; as fire entered the treatment on the slopes, fire intensities and flame lengths would decrease in the treated areas there by reducing the potential for crown fire initiation, a contributing factor to long range spotting.

The results of mastication includes a shift of live to dead fuel ratio, increased canopy base heights, break-up of horizontal continuity and the vertical arrangement of the fuel structure. Post treatment conditions within areas of masticated material would potentially cause increased fireline intensities in the short-term; however, as decomposition of the masticated material occurs, fireline intensities would gradually be reduced overtime. The age and density of brush within the units designated for mastication would determine the potential increase in fireline intensities. As brush densities increase, fireline intensities would increase. Reduction of rates of spread, flame lengths, and crown fire potential would occur overtime due to the change in fuel continuity and arrangement.

Follow up herbicide treatment would occur 2-5 years post-mastication. Herbicides use would inhibit the regeneration of brush species within the plantations. Previous material masticated would continue to decompose. Without the excessive regeneration of sprouting brush, these masticated areas would continue to serve as effective fuel treatments in the long-term. Overtime these treatment units would mimic open timber stands, with minimal surface and ladder fuels present, thereby continuing to serve as effective fuel treatments.

Areas selected as prescribed fire only treatments under the Proposed Action were selected to use natural and man-made barriers to reduce fireline construction and return fire to riparian areas and slopes where it is not feasible to conduct mechanical treatments. The proposed treatment units would facilitate reintroduction of fire into these areas due to lighter fuel loadings in the treatment units. Spotting potential, via lofting embers, into treatment areas is reduced due to lighter fuel loadings. This reduces the overall receptive fuel bed potential.

The prescribed fire only treatments, proposed under alternative 1, would be enhanced by the other treatment units proposed for mechanical thinning. Fire entering the untreated stands from treated stands would burn with less intensity as it enters the prescribed fire only treatments. This would result in a mosaic burn pattern in the untreated prescribed fire units where some pockets would burn under low intensity, other areas higher intensity, and areas where fire did not burn any vegetation. Within mechanically treated areas the majority of fire would burn under low intensity conditions due to the reduction in surface fuels and increase in canopy base heights. Moderate to high severity fire would possibly occur where vegetation still remained that is conducive to promoting these conditions. Overall the combination of treatment units proposed by alternative 1 promotes a mosaic pattern within the treatment units and facilitates reintroduction of fire in a safe and efficient manner.

Predicted tree mortality with implementation of the Proposed Action suggests that 10" dbh trees and greater would have a 90% chance of survival. Across all species size classes, it is expected that the general trend would be reduced mortality rates for each species.

With implementation of the Proposed Action, approximately 95% (5,431 acres) of the treatment area would exhibit less than 4 foot flame lengths. One hundred percent of the treatment units would produce rates of spread less than 20 chains/hr. Eighty-eight percent (5,017) of the project units would produce fireline intensities less than 100 btu/ft/sec with no areas identified as having the potential to produce greater than 500 btu/ft/sec. Ninety-nine percent of acres within the treatment units would produce surface fire conditions in the event of a wildfire during 90th percentile weather conditions.

The potential for extreme fire behavior currently exists and would continue to exist outside of the

treatment units. Alternative one affects approximately 31 percent of National Forest System Land within the project area. The remaining 69 percent of the project area would remain in its current condition with the ability to exhibit high severity fire condition on the landscape.

Cumulative Effect for Alternative 1

Rate of Spread is least affected by the proposed treatment units. However, when fireline intensities, flame length and crown fire potential are taken into account, currently, fire suppression strategies and tactics would be a parallel or indirect attack of a wildland fire under current condition due to the inability of fireline resources conduct fireline activities directly due to heat and spotting potential from torching trees. When the above listed fire behavior descriptors are taken in combination, the resulting fire behavior in the area after treatment, under Alternatives 1 provides for safer and more effective firefighting. The resource damage potential of a wildland fire in the treatment units is greatly reduced and opportunities to reintroduce prescribed fire within the understory are enhanced. Alternative 1 treats the greatest amount of hazardous fuels and provides the greatest amount of fuel treatment longevity.

ALTERNATIVE 3

Expected results would mirror Alternative 1 within the commercial treatment stands. Follow- up treatment would continue to keep surface fuels low, creating a separation between the canopy and surface fuel layers.

The majority of mastication is proposed in the northeast portion of the project area, along the ridge top within the Rubicon River Drainage. Under Alternative 3 the potential exists that within 5-10 years these fuels treatments would become ineffective. If follow-up mastication did not take place, the previously masticated material in combination with re-sprouting brush would cause these areas to return to conditions similar to those currently present. From a fire behavior standpoint, rates of spread, fireline intensity, flame lengths and crown fire activity would collectively increase to current conditions described in Alternative 2.

Cumulative Effects for Alternative 3

Cumulative effects are predicted to be similar to those described for Alternative 1.

ALTERNATIVE 4

Alternative 4 would produce effects similar to Alternative 1 at the landscape level. However, the reduction of 907 acres of treatment would not reduce measures of fire behavior within the acres eliminated as well as areas adjacent to eliminated treatments. Within the acres eliminated from treatment, a wildfire could move through the landscape due to continuity and arrangement of surface and aerial fuel loads, as simulated by fire behavior modeling. The reduction of these treatment acres may result in high intensity burning of Home Range Core Area habitat in the event of a wildland fire.

Under this alternative, an estimated 300 acres would be left untreated within the northeast portion of the Rubicon River drainage. Generally, these areas are on steeper slopes with east aspects. With the reduction in acreage, vegetation would continue to be uniform and continuous within the drainage, providing opportunity for a wildland fire to spread upslope to the ridge top. However, within this area, the ridge top is nearly flat with gentle slopes over a large area, and is proposed for treatment. The generally flat terrain in combination with the proposed treatment would provide an area for fire suppression personnel to coordinate strategy and tactics to contain or direct the spread of a wildland fire.

Along Nevada Point Ridge and Big Grizzly Canyon, treatment areas deleted with this alternative are adjacent to proposed treatment units near ridge tops with generally flat terrain.

Under this alternative 85% (4,847 acres) of the area would exhibit flame lengths under 4 feet. Acres producing flame lengths between 4 and 6 feet would increase from 4 acres with Alternative 1 to 96 acres with Alternative 4 and the area expected to produce flame greater than 6 feet would increase from 0 with Alternative 1 to 782 with Alternative 4. Big

would be below 100/btu/ft/sec with Alternative 4 for 75% (4,314 acres) of the area propose for treatment in Alternative 1 however, where Alternative 1 is expected to result in no areas producing fire line behavior greater than 500 btu/ft/sec, Alternative 4 is expected to have 781 acres that could produce fireline intensities

conditions. As everywhere, they have changed and would continue to change through time.

Fire Severity and Return Interval

As described above, fire has been an ecological force in the Sierra Nevada for more than 10,000 years ago. This role has varied over the millennia as climate has changed, however fire continues to shape vegetation and other ecosystem components (Sugihara, et al., 2006). Fire maintains ponderosa pine and sugar pine throughout their range, killing ever-invading shade tolerant species. In its natural role, fire is an ecological process Fire resets vegetation trajectories, sets up and maintains a dynamic mosaic of different vegetation structures and compositions, and reduces fuel accumulations.

Timber Management

Timber Sale records for the Eldorado, although incomplete, date back to 1912 when a sale was made in the Consumnes area. Trespass cutting in early days, up to and beyond the creation of the Forest Reserves, was frequent, and by some done as a matter of practice.

Until approximately 1940 timber cutting on the Eldorado was relatively light. The exchange of timber for land in the late 1930's, and demand for wood during World War II brought about heavier cutting on the National Forest. Between 1909 and 1958 the Eldorado ranged from a low timber harvest of approximately 5.6 million board feet from 1909 to 1921 to a high of 278.8 million board feet between 1951 and 1955. The majority of regulated timber harvest began around 1960 and continued into the late 1990's.

FIGURE 20 PHOTOGRAPH OF LARGE PINE STUMP IN PROPOSED TREATMENT UNIT FROM SELECTIVE HARVESTING IN THE EARLY 1900S

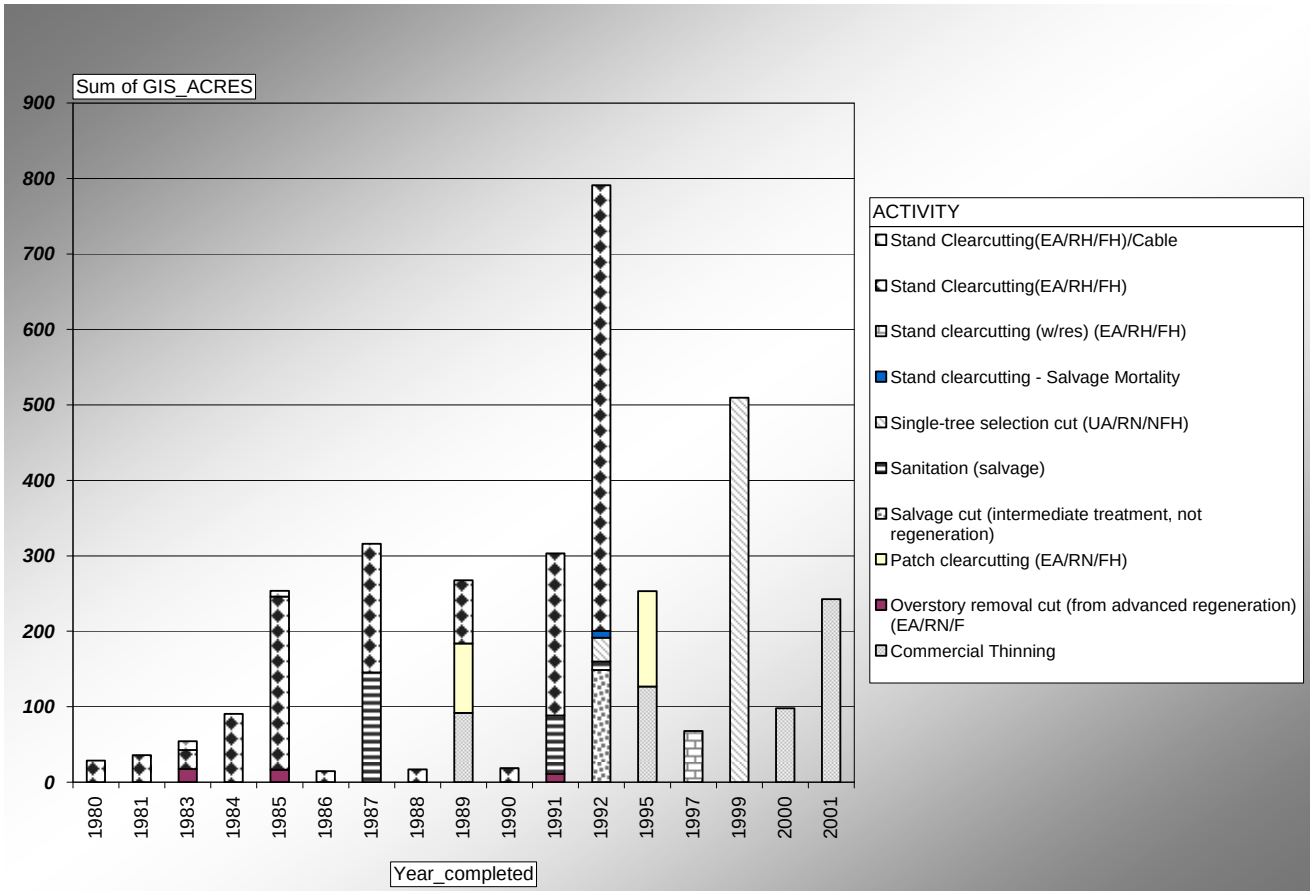

FIGURE 21 GRAPHICAL REPRESENTATION OF THE NUMBER OF ACRES OF COMMERCIAL TIMBER HARVEST ACTIVITIES BY YEAR SINCE 1980 ON NATIONAL FOREST LANDS IN THE BIG GRIZZLY PROJECT AREA.

Appendix C includes a table which illustrates the National Forest timber sales that were sold and harvested from 1962 to the present. Information from sales prior to 1985 is incomplete. When the timber management information was converted from written records to computer-based data, some of the information was unavailable; for example the name of the sale might not have been listed although the acres and type of treatment and year completed were known. In other instances, the database contained the sale name, acres and year of accomplishment, but lacked the activity code.

The relevance of the incomplete data depends on what is lacking. The name of a particular sale would be of little value in evaluating the environmental effects of the harvest. While knowing the activity code (thinning, sanitation salvage, clear cut, etc) is beneficial, the same knowledge can be gained through field visits, interpretation of aerial photography, or both. Incomplete or missing information of these types is not relevant to determining significant adverse impacts and the decision maker's ability to make a reasoned choice among alternatives. The effects of past timber harvest are accounted for in the assessment of the existing conditions to the extent that the past actions are still affecting particular resources being considered.

Over the course of the last approximately 150 years the majority of private lands adjacent to the project have been harvested. The harvest systems on these private lands have varied from even-aged regeneration cutting to economic selection cutting, depending on landowner objectives at the time. Recent harvest activities on private land are included in Table C-2 in Appendix C and the effects of harvest activities are included in the existing condition and the analysis of probable effects of National Forest management activities. The ways in which past harvests have affected the Big Grizzly project area are described below.

Insect and Disease Disturbance Factors

Most of the health concerns with these timber stands can be tied to overstocked or overcrowded conditions of the stands. The densely stocked stands cause a decline in the general health and vigor of all tree species due to high competition for moisture, sunlight, and nutrients.

The following major insects and disease agents are causing, or have the potential to cause major disturbances within the project area.

Root Disease

Root diseases have apparently increased significantly over the past several decades with the increase in host species abundance. Of particular concern is the dominance of white fir in the project area. One of the most efficient management tools is to reestablish resistant species on these sites.

Major root diseases include: Annosus Root Rot (*Heterobasidium annosus)*, and Shoestring Root Rot (*Armillaria sp.*).

FIGURE 22 PHOTOGRAPHS OF ANNOSUS ROOT ROT POCKET TAKEN WITHIN BIG GRIZZLY PROPOSED TREATMENT UNIT IN AUGUST 2008.

Foliar Diseases

Throughout the project area, mature white firs were found to have extensive white fir dwarf mistletoe (*Arceuthobium abieninum*) infection in association with *Cytospora abietis* cankers. Dwarf mistletoe plants can cause irregular branch growth ("witches brooms") on infected hosts. This abnormal growth is common on infected pine species; however, white fir dwarf mistletoe induces witches'-brooms rarely and only in old infections. As the mistletoe plant is an obligate parasite it is long dead before the *Cytospora* fungus has killed the branch. The *Cytospora* fungus is a weak pathogen and although it might be present it would not kill branches unless they have been previously wounded by the dwarf mistletoe. Dwarf mistletoes contribute to both water and nutrient stress. Over time the width of the tree crown shrinks and the host tree dies.

Dwarf mistletoe plants reproduce by "shooting" sticky seeds out about 30 feet from the host tree every summer and susceptible trees trees

then infected and the cycle is restarted. These parasitic plants are native components to the forest ecosystem, but human influences such as fire exclusion and partial cutting have served to increase the intensification, spread and severity of dwarf mistletoes.

Insects

Bark beetles are considered the most consequential insects in western coniferous forest, where they kill millions of trees annually. The principal beetles of concern are Douglas-fir tussock moth, western spruce budworm, and bark beetles, which attack Douglas-fir, and the fir engraver beetle and roundheaded fir borer which attack true firs. For pines, the most damaging insects are western pine beetle, the mountain pine beetle, the red turpentine beetle, and the California five spine-ips.

Silvicultural control measures are the most efficient method for managing bark beetle populations. The most effective strategies for managing beetle populations are those that are focused on preventative measures that involve reducing stands susceptible to beetle infestations through maintenance of vigorous stands. Thinning stands would prevent or minimize beetle-caused mortality.

FOREST COMPOSITION

The composition of a forest changes over time. Historically, fire was the primary ecological process that determined forest composition. Recurrent, low intensity fires regulated competition for limited resources such as water and nutrients by reducing shrubs and thinning out the understory shade tolerant tree species, such as white fir and incense cedar. With effective wildfire suppression, forests have become overstocked with shade-tolerant tree species. This condition has resulted in a general loss of vigor in all species, particularly ponderosa pine, sugar pine and oak that require full sunlight to thrive.

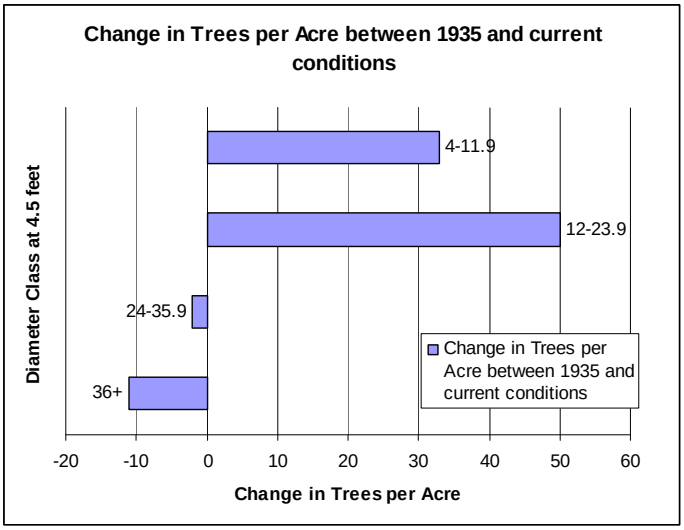

FIGURE 23 CHANGE IN THE AVERAGE NUMBER OF TREES PER ACRE IN EACH DIAMETER CLASS BETWEEN VTM DATA RECORDED IN 1935 FOR MIXED CONIFER STANDS IN THE SIERRA NEVADA AND CURRENT CONDITIONS WITHIN THE BIG GRIZZLY PROJECT.

Diameter distributions are considerably different within the project area from historic distributions described for the Sierra Nevada Range in Boudin (1999) with a large increase in trees between 4 and 24 inches and a decrease in trees greater than 24 inches. These changes within the Big Grizzly project area are consistent with changes observed throughout the Sierra Nevada mixed confer forest.

Species composition within the treatment units is also considerably different than the basal area dominance described by Boudin (1999) for the mixed conifer forest type of the Sierra Nevada. Historically, pine dominated approximately 73% of the landscape, while fir dominated approximately 18%. Current conditions in the project area derived from analysis of the Forest Vegetation Layer show an increase of almost 100% in the area dominated by white fir and a decrease in the area dominated by pine.

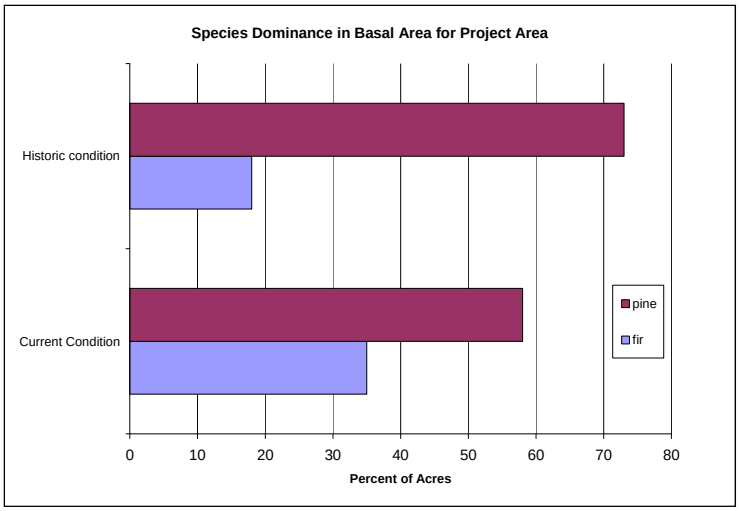

FIGURE 24 CHANGE IN AREA DOMINATED BY PINE AND FIR FROM HISTORIC CONDITIONS DESCRIBED IN BOUDIN (1999) FROM VTM DATA AND CURRENT AREA OF TREATMENT UNITS DOMINATED BY PINE AND FIR WITHIN THE BIG GRIZZLY PROJECT AS A PERCENT OF ACRES

Analysis of stand exam data shows that within the Big Grizzly project units, over 45% of the current basal area per acre for areas proposed for treatment with commercial thinning, is white fir; and the basal area in white fir is now made up by high numbers of predominately small trees, where fewer, large white fir historically contributed to the basal area. Basal area of incense cedar makes up approximately 19% of stands while sugar pine has fallen to 3% basal area per acre. Ponderosa pine currently makes up approximately 20 percent of the basal area within the project units.

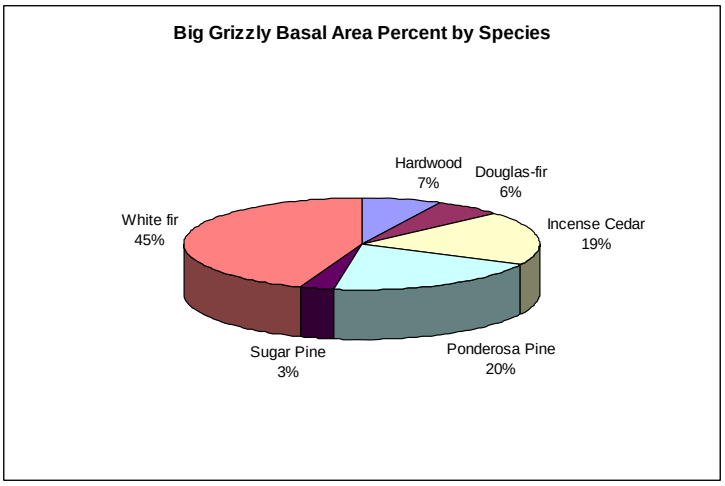

FIGURE 25 AVERAGE SPECIES COMPOSITION ACROSS THE BIG GRIZZLY PROJECT COMMERCIAL TREATMENT UNITS.

Current Condition in Non-Commercial Treatment Stands

Plantation stands established in the project area 10-20 years ago due to wildfire and timber harvest have been proposed for non-commercial treatments in order to reduce competition with brush and between trees. Current conditions in these plantation stands average 60 percent brush cover (with a range of 35-90%) and 6 foot tall brush (with a range of 3-15 feet). Trees range in size from 4 feet in height to 20 feet with some individual or pockets of larger remnant trees scattered within plantations.

Brush species are highly competitive with growing trees, reducing both height and basal area growth. The dominant brush species of concern within these stands include white-thorn (*Ceanothus cordulatus*), greenleaf manzinita (*Arctostaphylos patula*), bitter cherry (*Prunus emarginata*), and deerbrush (*Ceanothus integerrimus*). Whiteleaf manzanita (*Arctostaphylos viscida*) and brush chinquapin (*Castanopsis sempervirons*) are also located as a large component within some stands.

FOREST VEGETATION CONCLUSIONS

Important ecological changes in the Big Grizzly area have occurred with fire suppression and widely scattered timber harvest over time. Early century selective logging removed some of the larger diameter trees. Prior to 1935 these sites may have supported approximately 122 trees per acre greater than 4 inches dbh with ponderosa pine and sugar pine dominating (Boudin, 1999). Historically theses thick-barked pines withstood frequent low intensity fires. Today stands within the Big Grizzly area average approximately 248 trees per acre dominated by white fir, and are largely missing the larger diameter trees.

Changes in forest composition have some potentially significant effects in today's forest. Conversion of tall, well-spaced pine, to shorter, densely stocked fir results in hazardous fuel ladders. Such conditions change fire behavior and the behavior of insects and diseases within these stands threatening important resources. Significant changes in fire behavior have been identified for mixed-conifer Sierra Nevada Forests (Miller et al. 2009).

The amount of old growth in the Big Grizzly area falls below the historic range, and the composition, structure, and distribution of old growth has changed. Most of the late-seral forest in the

assessment area is located outside proposed project units.

MODELING

The Forest Vegetation Simulator (FVS) Growth and Yield Model (USDA Forest Service, 2003b) is used to portray and provide information for the existing condition and aid in analyzing and predicting the immediate, short and long-term effects of the alternatives for selected vegetation attributes. FVS is a distant-independent individual tree growth and yield model. Within the model mortality is based on a standard coefficient until the stand reaches a specific density, the mortality becomes based on stand density as measured by stand density index. Maximum SDI for species within the Big Grizzly project are as incorporated in the FVS western Sierra Nevada variant are: 571 for ponderosa pine and Jeffery pine, 647 for Sugar Pine, 547 for Douglas-fir, 382 for Black Oak, 759 for White fir, 800 for red fir, and 706 for incense cedar. Oliver (1995) however showed that for relatively pure ponderosa pine stands density is held at 365 by Dendroctonus bark beetles.

FVS treats a stand as the population unit and utilizes stand examination data. Modeling criteria used in the analysis are presented in Walsh (2009). Averages presented for the project are based on area. Changes and trends of attributes Are analyzed in the following years: 2009 (inventory), 2010 (immediate effect), 2014 (short-term effects) and 2029 (long-term effects).

Important, measurable attributes for forest vegetation include the average number of trees per acre, basal area per acre, canopy cover, species composition, the distribution of size classes, and stand density index (SDI). SDI is used evaluate completion between trees and to evaluate the relative risk of a stand to insect and disease attack by comparing SDI to the Maximum SDI for a specific species.

EFFECTS

ALTERNATIVE 2 (NO ACTION)

No activities would be undertaken with this alternative. Direct impacts from project related activities would not occur to vegetation in the project area. Implementation of the No Action Alternative would not contribute to the attainment of the Desired Condition for the project area. There would be no thinning of suppressed, intermediate, and codominant conifers with the project. There would be no reduction of competing brush cover or reduction of tree density within plantations. The continued susceptibility of the area to adverse wildfire effects from high fire hazard potential and insect and disease mortality endangers the long-term sustainability of the stands. No action is still a management decision and would have indirect consequences to forest vegetation resources.

Since fire is the primary mechanism that historically controlled forest structure and composition in this area, it is safe to assume that other components of the ecosystem have likewise been altered with fire suppression. Active fire suppression is an action that would continue disruption of the fire return interval. Without silvicultural treatments, this disruption would further trend forest composition and structure away from desired conditions.

White fir, cedar, and Douglas-fir (shade tolerant species) would continue to dominate the understory layer, while oaks, ponderosa and sugar pine would continue to be displaced. Simply because these shade tolerant species are more successful at regenerating in the absence of canopy openings created by fire or timber harvest. Given that these areas already have a limited supply of moisture and nutrients, excessive numbers of trees further limits individual tree productivity. Without fire to modify stand structures and compositions, insects and disease would act as the agents of control as these stands continue to become more overstocked and stressed with unnatural amounts of fuel build up.

As described above, fires would currently burn with much more intensity than they did historically on these sites, with much different outcomes. Old growth stands, containing valuable “remnant” ponderosa and sugar pine that would have historically survived light intensity burns would likely be killed, and the risk of permanent site damage and alteration of species composition would increase.

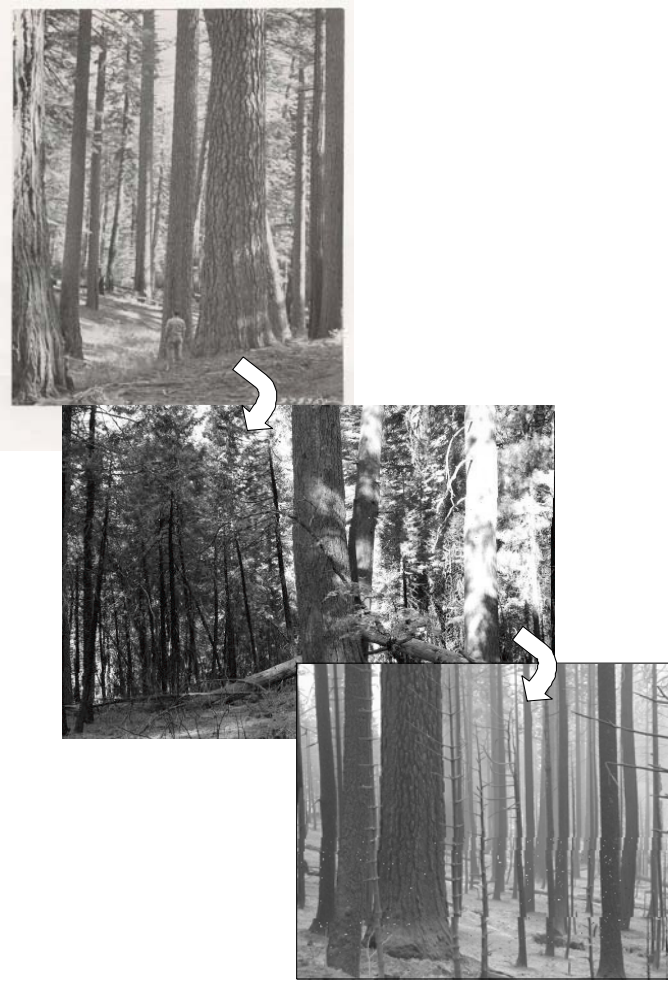

FIGURE 26 CHANGES IN FOREST COMPOSITION OVER TIME WITH NO TIMBER HARVEST OR UNDERSTORY BURN TREATMENT.

Individual stand densities of sampled stands range from Stand Density Indexes of 254 to 546 with 68% of the sampled stands above the 60% threshold of concern for ponderosa pine and 20% above the 60% threshold of concern for white fir, based on maximum stand density indexes for each individual species. With no treatment, stand densities would continue to be at a level above the threshold of concern in both the short- and long-term for the more desirable shade intolerant species. Increasing stand densities would continue to increase risk of insect caused mortality for the stands as a whole. The principal insects of concern are Douglas-fir tussock moth, western spruce budworm, and bark beetles, which attack Douglas-fir, and the fir engraver beetle and roundheaded fir borer which attack true firs. For pines, the most damaging insects are western pine beetle, the mountain pine beetle, the red turpentine beetle, and the California five spine-ips (Helms and Tappeiner, 1996).

Absent the occurrence of an epidemic insect outbreak or a high severity wildfire, the number of trees per acre is expected to remain fairly constant for the short and long-term, except where Annosus root rot is expected to continue to reduce the number of white fir. Likewise the average diameter of trees within the stand is expected to increase slightly over time.

Height to live crown would continue to be low. With the continued establishment of a shade tolerant understory, fuel ladder structure would continue to increase. Regeneration and growth of grasses, forbs, and brush species in the understory is expected to continue to decrease over time as the amount of growing space available to understory plants is reduced by continued accumulation of a heavy litter layer.

The number of snags and down logs is expected to increase over the long-term, primarily due to mortality caused by insect and disease. Down logs 12 inches and larger would only slightly increase due to normal snag fall. The recruitment rate of snags and down logs would continue to be dependent upon the interplay of precipitation levels, stand density and other natural elements, such as the incidence of insect attack, natural mortality, and amounts of windthrow. The general upward trend expected in snags and down logs would continue until conditions suitable for tree growth improve. Should a wildfire occur it could potentially create a tremendous number of new snags and down logs while consuming existing snags and down logs.

FVS projections for the number of snags per acre with No Action shows that the number of snags per acre greater than 18" dbh is expected to continue to increase over time. Modeling is believed to most likely under-predict the number of snags that will result over the next several decades as it did not include parameters for the current drought and insect related mortality that has been evidenced as increasing on the Georgetown Ranger District, and within the project area within the last year.

In the short- and long term it is predicted that canopy cover within the project area would remain constant except where existing Annosus root rot is expected to continue to result in canopy cover

reductions. Annosus infection is expected to continue to diminish stand vigor and kill individual trees, as it spreads through root contact from infected to non-infected host trees. Expansion of root rot is expected to continue until species composition within stands and spacing between host species reaches a level that is not conducive to further spread of the disease. Should a wildfire or epidemic insect outbreak occur, canopy cover could be substantially reduced or completely eliminated in some areas and could take decades to more than a century to recover present values.

Overall growth of plantation trees is expected to remain slow. Trees would continue to compete with brush for water and nutrients, reducing height growth and volume growth. Plantation stands would remain highly susceptible to high levels of mortality from wildfire and insect attack.

Cumulative Effects for Alternative 2

Because no direct impacts would result from project related activities, no cumulative effects to forest vegetation are expected from implementation of the No Action Alterative other than the continuation of the effects of fire suppression and historical management practices.

ALTERNATIVE 1 (PROPOSED ACTION)

The implementation of this alternative would reduce the likelihood of tree mortality caused by insect attack and would reduce potential adverse effects of a wildfire to forest vegetation within the project area. Some of the anticipated effects of implementing the Proposed Action would include:

The reduction in the likelihood of an insect epidemic and the improved resiliency of treated stands following wildfire would provide better assurance that the existing stands could be carried into the future.

- The risk of loss of high value large trees and plantations would be reduced.
- The project area would be managed as more of a mosaic, without large continuous, even-aged stands dominating the landscape. This would allow greater variation in stand age, species composition, structure and function, thus providing additional resilience against insect or disease, and resilience of the stand to wildfire. Prescriptions to retain within stand heterogeneity by retaining clumps of trees and creating openings should provide for a more sustainable structure while allowing stands trajectory to be changed to favor a larger composition of shade intolerant pine and hardwood.
- A more constant flow of forest products would be assured, thus facilitating long-term vegetation management options by maintaining local timber processing infra-structure.

STANDS WITH A COMBINATION OF COMMERCIAL AND NON- COMMERCIAL REMOVAL

Data presented in this section included all stands with commercial sized removal components included in the Proposed Action including: older plantations, non-plantation stands, and stand improvement units.

A mix of treated stands and dense, non-treated areas within the project area ensures a wide range of variability in stand conditions across the landscape. Less than 35% of the land managed by the Forest Service is proposed for treatment in this project area. While averages are used to describe stand conditions both pre and post treatment, there is not an effort to create average conditions in any location.

While specific, individual marking guides are not written for each slope, aspect or slope position; slope, slope position and aspect are included in project design through placement of SPLATs and treatment areas. Also, because thinning from below focuses removal on the trees that provide a fuel ladder and those trees that meet removal criteria, stands and areas within stands differ in structure post treatment based upon species composition and pretreatment distribution, which prevents uniform conditions. For example if a stand is on a northern slope and has a high component of dense white fir in the overstory and in the understory, a high component of white-fir would remain in the overstory post treatment and be reduced, but still present in the understory. If a stand is on a southern slope and has a higher component of pine in the overstory, but a large amount of in growth in white fir in the understory, the high component of pine in the overstory would remain, but the amount of fir in the understory would again be reduced. In both of these scenarios the white fir in the understory makes the stands fairly homogonous across the landscape. These and other shade tolerant understory species would be reduced, but the overstory stand composition, and density resulting from slope position and aspect would reflect the existing stand conditions and therefore would produce different

forest conditions post treatment. Retention of structure within microsites of stands that support higher basal area and increased species diversity operates similar to the descriptions for north and eastern aspects, and therefore should also have preserved within stand heterogeneity as described for aspect differences with the proposed removal and retention strategy.

Effects described to stand structure below include only those stands within the project area proposed for treatment. Greater than 75 percent of the project area is not proposed for treatment with this project.

Stand Density and Structure

Stand densities, would be reduced within proposed treatment units to a level below a threshold of concern in the short-term based on maximum stand density index for species of concern. In the long-term stand densities would increase to near current levels due to growth of remaining trees and regeneration of shade tolerant species.

The number of trees per acre in the smaller diameter classes would immediately be reduced through harvest. About half the existing conifers below 20-inches in diameter would be removed within treatment units, and roughly 15 percent of the trees between 20 and 30 inches in diameter would be removed. The bulk of the removal of trees 20-29.9 would occur within stand improvement treatment areas due to the large number of Annosus infected white fir.

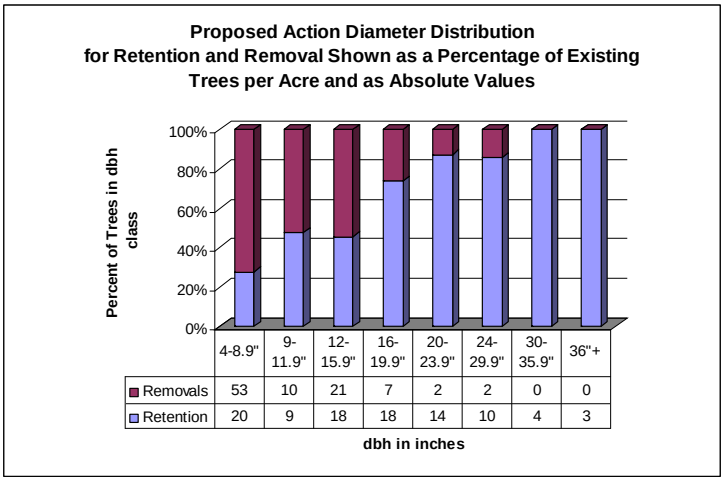

FIGURE 27 GRAPHIC REPRESENTATION OF PROPOSED REMOVAL AND RETENTION WITH THE PROPOSED ACTION.

Retention of trees with defect that are identified as valuable for wildlife use is not expected to reduce the genetic quality of the stand as genetic forks usually occur lower on the tree and do not provide for structures that are beneficial for wildlife use. Micro-habitats that have been shown as indicators of natural mature and natural old growth stands include broken tree top, bayonet top, crack or scar, bark loss, hollow chamber, stem cavity with decay, bark pocket with and without decay, bark bowl, burl, heavy resinous and bark burst. These characteristics are typically caused by environmental factors and not due to a genetic trait.

Some reduction in trees providing microhabitat can be expected in the smaller diameter classes <20 inches. It has been found that overstory removal treatments of any degree typically reduced these structures significantly compared to untreated stands (Michel and Winter, 2009), however it is not expected that a thin from below treatment with identification for retention of these specific characteristics in trees greater that 16 inches, such as proposed, would result in large decreases in these microhabitats. This is because even without specifically identifying these trees for retention, many of the trees with wildlife use characteristics are in the larger diameter classes and in the overstory of the stand. Michel and Winter (2009) found that the abundance of different microhabitats on Douglas-fir trees strongly increased on trees with a greater than 27 inch dbh, typically larger than the size class proposed for removal with this project.

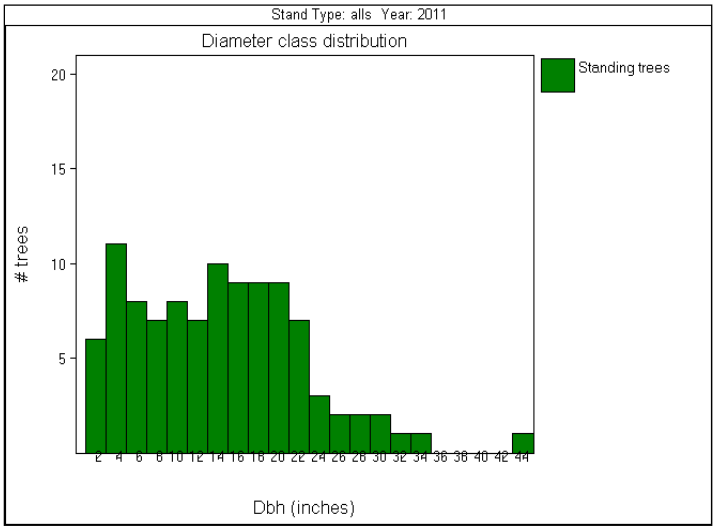

FIGURE 28 GRAPHIC REPRESENTATION OF DIAMETER DISTRIBUTION WITH THE PROPOSED ACTION

Over time the number of trees per acre in the larger diameter classes would increase while the number of

trees per acre in the smaller diameter classes is expected to remain fairly stable from follow-up treatment with prescribed fire. Planting within stand improvement units would increase the number of trees per acre of desired species in smaller diameter classes for treatment areas.

Basal area would decrease immediately, mostly from the removal of many small trees. An average basal area reduction of 20% would occur in treatment units with a range of 10-45% removed from individual treatment units. Basal area is expected to increase as tree growth is concentrated on the larger diameter trees and as a result of increased growth rates of trees 10-30 inches dbh.

Where basal area and size class distribution is presently lower than site capabilities due to history of the area, treatments are designed to increase the growth on trees and ensure future basal area and density in appropriate size classes to meet desired conditions.

Because prescriptions are applied on a site specific basis, in some cases this would [illegible] c o n d i t i

within treatment units retaining denser canopy cover than other areas. Averages in canopy cover would be maintained to meet standards and guides in the 2004 SNFPA, however continuous canopy cover within any given unit is not the desired outcome of those standards and guidelines. HRCA land allocation areas within proposed treatment stands would retain an average canopy cover at or above 50%. Areas of greater than 60% canopy cover are expected to be retained where canopy cover is currently above 65-70+% with larger diameter trees and multiple layers of canopy structure. Retention in canopy cover has been monitored in the Quintette Fuels Reduction Project in stands of large trees that had dense canopy cover pre-treatment. Monitoring has shown that greater than 60% canopy cover has been retained in these areas with implementation of similar prescriptions for tree removal. Post treatment examination of Sundawg Fuels Reduction has shown that canopy cover in smaller diameter stands has been maintained above 50% with similar thinning from below prescriptions for tree removal. Additionally, retention of additional intermediate structure within specific units identified for ladder structure retention would provide for additional canopy cover retention in those areas.

Through the expansion of canopy gaps within stand improvement units, canopy cover would be reduced to facilitate planting of desired species in areas with already low and deteriorating canopy cover. Canopy cover within the matrix areas of these stands (areas in between canopy gaps) and within HRCA portions of these units would be preserved at above 50% canopy cover similar to the thinning from below units. In areas where gaps are placed existing canopy cover is low and could be reduced 10-20%. Planting of desired species would contribute to a future stabilization in canopy cover within stand improvement units.

A key measure of stand structure, California Wildlife Habitat Relationship Class (CWHR) is not generally expected to be changed by the proposed treatments for the majority of the treatment area. This is because the relative percent of cover occupied by each tree species in the overstory would remain largely unchanged through the removal of overtopped and intermediately positioned trees. Changes to the size measure of CWHR would not be reduced in any case. However, because canopy cover reductions are expected to range from 4-15% some stands would be reduced in density. Examples where reduction in density and/or increases in size can be expected are discussed below. There are not a large percentage of these stands within the project units. For definitions of the size and density categories for CWHR see table 15.

TABLE 15 CWHR TREE SIZE AND CANOPY COVER DEFINITIONS

Standards for Tree Size			Standards for Canopy Closure		
WHR	**Size Class**	**dbh**	**WHR**	**WHR Closure Class**	**Ground Cover (Canopy Cover)**
1	Seedling Tree	<1”	S	Sparse Cover	10-24%
2	Sapling Tree	1”-6”	P	Open Cover	25-39%
3	Pole Tree	6”-11”	M	Moderate Cover	40-59%
4	Small Tree	11”-24”	D	Dense Cover	60-100%
5	Medium/ Large Tree	>24”			
6	Multi-layered Tree	Size class 5 trees over a distinct layer of size class 4 or 3 trees, total tree canopy exceeds 60% closure			

Stands that are currently classified as 4D, but that are at the lower end of both the canopy and size measures (i.e. near 12 inches average diameter and near 60% cover) would be reduced to higher canopy measures of 4M (i.e. 50-59%). The majority of these stands have a fairly even canopy structure that has not yet stratified into canopy layers. These stands have very high tree density. These areas include portions of stand 320-91, which is an older, even age pine plantation, and areas of even-age, dense incense cedar within some of the thinning from below units. In these units thinning trees would reduce canopy cover density because each tree removed contributes to the overstory canopy.

Likewise, stands that are currently classified as 4D with stratified canopies that are at the upper end of the size measure, but at the lower end of the canopy measure for that classification (i.e. average diameter near 24 inches and canopy cover near 60) are expected to become classified as 5M due to the removal of smaller trees in the main canopy.

A reduction in density measures of other CWHR size classes would follow similar trends to those described for 4D stands. CWHR 5M and D stands make up a very small percentage of the treatment units. These stands are not expected to be changed in either size

or density. Experience with similar treatments on the Georgetown District on the Eldorado National Forest have shown that canopy cover in 5D and 5M stands are typically preserved, as the main contributors of canopy cover are the larger trees in the stand that are not being removed though the thinning from below prescription.

Within stands proposed for stand improvement through gap creation, CWHR classes could be reduced where canopy gaps are created. This reduction would occur quicker than expected reductions without treatment; however, in the long-term CWHR classes in these areas would be stabilized, while without treatment they would continue to deteriorate over time. These reductions are predicted to move stands from density measures of P (below 39%) to S (below 25%).

Because management direction is to retain CWHR Class 5M and 5D habitat within the HRCA land allocation to the extent possible, stands with these classifications were primarily avoided during placement of SPLATS and treatment units. Within the project area there are currently 637 acres of 5M and 1880 acres of 5D. Approximately 18% of the identified 5M and 13% of the 5D classes have been included in treatment units. Of the area proposed for treatment 95% of the 5M and 84% of the 5D are within proposed thinning units, the remainder are in prescribe burn only treatment units and along edges of brush removal or mastication units. Additionally, not all of the 5M and 5D areas within thinning units would have treatment occur within them, as some are within Riparian Conservation Areas and other protected areas. For the most part, large contiguous areas of 5M and 5D class vegetation were avoided with treatments, however some areas identified as 5M and 5D that were more isolated along the Devils Peak, Nevada Point East and Nevada Point West ridge tops were included in treatment units. Due to the slope and aspect it is expected that these ridge top areas would have historically supported a more open pine dominated stand and are not suitable for supporting large areas of dense conifer stands. Other areas of 5M and 5D were included where logical layout of treatment units for affecting landscape fire behavior does not facilitate avoidance.

Because the majority of 5M and 5D identified vegetation has not been included in treatment units, and because treatments are expected to mostly preserve this classification inside treatment units, only minor immediate reduction in stands classified as 5M and 5D is expected within the project area. In the short and long term it is expected that treatment would facilitate the development of 4M and 4D areas currently identified within treatment units to develop into 5M and 5D stands sooner that without treatment. Treatment of these stands is also expected to aid in the protection of the large contiguous areas of 5M and 5D identified stands within the project area from catastrophic wildfire and insect mortality.

Proposed treatment activities are expected to benefit the regeneration and growth of grasses, forbs, and brush species in the understory, increasing the amount of area occupied by these plants within treatment units. Tractor piling and prescribe burning are expected to increase the amount of growing space available to understory plants by reducing the heavy litter layer that exists in many of the proposed units. Prescribe burning is likely to stimulate sprouting in some species. Canopy cover reductions from proposed thinning would increase the amount of light hitting the forest floor, aiding in survival of understory vegetation; however, brush height growth is expected to be slow when compared with more open conditions due to the 50% canopy cover retention minimum in most areas.

Short-term direct effects upon snags and down logs are expected from proposed activities. Changes to snags and down log numbers are likely to occur as part of the prescribed fire, machine piling and pile burning activities. The effect of prescribed fire upon the number of snags and down logs is difficult to predict. Age, size, species fuel moisture levels, duff depth, and location of snags and down logs affect both tree mortality and down log consumption. In general, down logs have been shown to decrease in number and piece size, and shift toward less decayed pieces with thinning and burning (Innes et al., 2006)

It is anticipated that some additional snags would be created through prescribed fire activities and pile burning, and that down logs would be replaced by snags that fall. Harrod et al (2009) showed that the number of snags per acre and the basal area of snags per acre increased in thinned and burned stands compared to no treatment. Innes et al. (2006) found that harvest completed in accordance with the CASPO (California Spotted Owls) rules (PSW-GTR-133) with and without prescribed burning increased the volume and mass of large snags (>17 inches dbh), but decreased snag numbers/acre, indicating that

large snags were recruited, but that their overall frequency decreased across the landscape. Personal observations during post treatment monitoring on units within the Quintette and the Smarty Jones projects that have been thinned and burned have confirmed that

provides a beneficial effect by removing pests that infest the acorn crop and by removing competing vegetation. In addition, root crown sprouting of hardwoods is expected to occur.

Modeling did not show an increase in hardwoods, due to the fact that hardwood regeneration values were not input into the model. Despite the lack of modeled increase in hardwood numbers, over the long-term, reduced stand densities and reduced competition from conifer species are expected to benefit the establishment and survival of oaks within the treatment units. Release of California black oak from overtopping conifers is expected to increase the vigor of individual oak. Due to the irregular distribution across the treatment areas, benefits to oaks would not be uniform.

STANDS WITH NON-COMMERCIAL TREATMENTS ONLY

Reduction in competition to plantation trees through treatment of competing brush and reduced tree density is expected to increase height and diameter growth, and reduce the risk of mortality from wildfire and insect attack. Brush competition within ponderosa pine plantations in California has been shown to significantly reduce height growth and to consistently reduce basal area growth (Barrett, 1982). Oliver (1984) found that brush cover above 30% overwhelmed any inter-tree competition due to spacing, slowing growth of all plantation trees. Trees are not expected to immediately increase their rate of growth after treatment; however within 5 years the rate of stem volume production and height growth are expected to appreciably increase with increased availability of nutrients and water. As a result trees are expected to reach canopy closure considerably sooner than with no treatment, better enabling trees to reduce cover of competing brush in the future and more quickly providing components for old forest structure development.

FIGURE 29 PACIFIC SOUTHWEST RESEARCH STATION BALDERSTON PLANTATION EXPERIMENT ON THE GEORGETOWN RANGER DISTRICT SHOWS BRUSH COMPETITION SIGNIFICANTLY REDUCES GROWTH OF TREES OVER TIME.

Where mastication of brush and small trees is proposed, a mat of material would be left behind to cover the ground; however, vigorous resprouting of whitethorn, greenleaf manzinita, bittercherry, deerbrush, and brush chinquapin is expected. Herbicide treatments are expected to largely reduce brush regrowth to below 30% cover. Brush cover is expected to be replaced within the first few years post treatment by grasses and forbs.

Cumulative Effects for Alternative 1

Those effects listed above could be expected to continue. It is expected that this project would not contribute to the trend of declining large trees (greater than 30 inches dbh) within the project area, caused mainly by past harvest practices and mortality of larger trees removed in salvage operations. This project is expected to alter snag and down log location and distribution within the project area, however this project is not expected to contribute to a substantial decrease in these structures that resulted mainly from past treatment practices. It is further expected that this project would reduce the trend of non-plantation stands toward species dominance by shade tolerant white fir and incense cedar, thereby contributing to the sustainability of stands into the future.

The planting of pines would contribute to the increase in pine across the landscape and would contribute to more sustainable stands into the future. Benefits to oaks from treatment are expected to decrease the trend of oak reduction within the project area. With follow-up treatment of project

produced stumps (14 inches and larger) with Sporax, this project is not expected to result in further contribution of Annosus root disease spread within the project area. No foreseeable future projects are planned within the project area.

Projects in close proximity to the project area include the Hartless Ridge and Black Smith Flat projects. These projects are guided by the same management objectives as the Big Grizzly Project, and are expected to result in similar cumulative effects to a more sustainable species composition and stand structure.

ALTERNATIVE 3

Because Alternative 3 would only affect follow up treatment in planted areas and in a majority of the plantation stands proposed for treatment, effects from this alternative are expected to mirror those effects described above in Alternative 1 for commercial stands.

In non-commercial stands mastication with no follow-up of herbicide is expected to have limited success in controlling competing brush even with a second follow-up mastication treatment due to the vigorous resprouting of competing brush species. Although, mastication would immediately reduce the brush component in treated stands, mastication of heavy compositions of re-sprouting brush would result in little to no short or long-term control of brush competition within the stands. With continued brush competition, tree growth within these stands would remain slower and risk of loss to wildfire would remain high.

FIGURE 30 PHOTOGRAPH OF MASTICATION OF RESPROUTING SNOWBRUSH IN THE WHITMORE FUEL REDUCTION STUDY SITE IN CALIFORNIA IN THE 1ST SPRING FOLLOWING MASTICATION AND AFTER 16 MONTHS TAKEN BY PACIFIC SOUTHWEST RESEARCH STATION. IN THIS CASE BRUSH SPROUTED BACK TO COVER NEARLY 90% OF THE GROUND AND AT HEIGHTS GREATER THAN 4 FEET IN JUST OVER 1 GROWING SEASON.

Furthermore, because of the high cost of mastication, economic limitations could result in fewer acres of initial plantation treatment accomplished or a reduction in follow-up treatment which would allow brush establishment to re-occur quicker than with the Proposed Action. Implementation of this alternative would have reduced benefits in the reduction of insect and disease risk and resiliency to wildfire within stands proposed for non-commercial treatment. This would reduce the assurance that investments in plantations would be carried into the future.

Cumulative Effects for Alternative 3

Cumulative effects from Alternative 3 would be similar to those effects described for Alternative 1.

ALTERNATIVE 4

Stand density and structure, and species composition are expected to be similar on the treated areas to those effects described in Alternative 1. Benefits from treatment described under Alternative 1 would be reduced however by not treating 820 acres with thinning from below prescriptions designed to reduce stand density and ladder fuels. Compared to the

Proposed Action, eighteen (18) treatment units would be dropped from the project proposal, while several others would be reduced in size and shape. Non-commercial treatment of small plantations would result in the same benefits to growth and survival as described under the Proposed Action.

The reduction in the percent of the land treated would result in retention of larger stands with higher stand densities and ladder fuels over the landscape, putting the area at higher risk for insect attack and wildfire mortality than with the Proposed Action. White-fir and cedar in-growth would continue to dominate these areas competing with more desirable pines and oaks. Given that these areas already have a limited supply of moisture and nutrients, excessive numbers of trees further impedes individual tree growth and vigor.. Overtime, the species composition of the untreated stands is not expected to improve due to a lack of regeneration of pines and oak, even with continued mortality caused by insects, diseases, and droughts.

Cumulative Effects for Alternative 4

Cumulative effects from Alternative 4 are expected to be similar to the Proposed Action.

ALTERNATIVE 5 (NON-COMMERCIAL ALTERNATIVE)

A 12 inch diameter limit would retain approximately 17 more trees per acre greater than 12 inches than the Proposed Action and canopy cover would be approximately maintained at current levels in the short term. The majority of the additional trees retained are white fir and incense cedar which would not aid in improving the species composition of the treatment units or the project area.

Under this Alternative, basal area of ponderosa pine would be maintained at levels similar to those in the No Action Alternative for the next several decades and would be higher than the basal area retained in the Proposed Action. After about 20 years the basal area growth of ponderosa pine would cease with the Non-Commercial Alternative, and actually start to decrease. The overall basal area of ponderosa pine under this Alternative would be maintained slightly higer than with the No Action Alternative over the long-term. Hardwoods are in large measure not benefited by the Non-commercial Alternative as shown by the continued decrease in basal area for the hardwood species. Sugar pine would benefit slightly from the decrease in competition compared to the No Action Alternative; however, the decrease would be less than with the Proposed Action.

Modeling shows that the Non-commercial Alternative preserves more large trees (<20 inches) into the future compared to the No Action Alternative and that for the timeframe of the analysis this alternative would retain more trees per acre greater than 20 inches within the treatment units compared to the Proposed Action. However, average stand densities would remain above 60% of the maximum for ponderosa pine, meaning that the majority of the project units if treated with a 12 inch diameter limit are not expected to be reduced below the 60% threshold of concern for ponderosa pine. Therefore, ponderosa pine, sugar pine, Douglas-fir and black oak would still remain at increased risk for drought and insect attack mortality and objectives to improve stand vigor and resilience would not be achieved. Given that these areas already have a limited supply of moisture and nutrients; excessive numbers of trees on them further impedes individual tree growth and vigor..

No improvements to species composition are expected to occur in stand improvement units without the expansion of existing gaps and planting of desired species. In these stands canopy cover would continue to decrease as the expansion of Annosus root disease and insects within the stands continues to kill the predominately large areas of white fir. Therefore, more snags and downlogs are expected in the short-term compared to the Proposed Action.

Cumulative Effects of the Non-Commercial Alternative.

Cumulative effects of the Non-Commercial Alterative would be similar to those described for the No Action Alternative.

MODIFIED ALTERNATIVE 1

For units that would be treated the same under the Modified Alternative 1 and Alternative 1, effects to stand density and structure, and species composition are expected to be similar on the treated areas to those effects described in Alternative 1.

In the 7 treatment units with reduced dbh limits and less intensive thinning prescriptions, implementation of this Alternative is expected to preserve 8-10% greater canopy cover on average and approximately

60 square feet of basal area in approximately 15 trees per acre greater than 16 inches compared with Alternative 1. The majority of the additional trees retained are white fir and incense cedar which would not improve the species composition of the treatment units. However, some additional pine trees would also be preserved, slightly reducing the immediate decrease in pine basal area with project implementation. There would be a moderate decrease of white fir and incense cedar, mainly in the understory (suppressed and intermediate crown classes) and a slight increase in the percent of stands dominated by shade intolerant species such as ponderosa pine, as measured by trees per acre and by basal area, due to treatment prescriptions.

Stand densities in the 7 units with reduced dbh limits and less intensive thinning prescriptions,would not be reduced to a level below the threshold of concern for pine indicating that ponderosa pine, sugar pine, Douglas-fir and black oak would still remain at increased risk for drought and insect attack mortality. Given that these areas already have a limited supply of moisture and nutrients; excessive numbers of trees on them further impedes individual tree growth and vigor., and so individual growth rates, on average in these stands are expected to be lower than with the Proposed Action. However, benefits to individual trees would be expected due to reduced competition related micro-site improvement. Impacts to snags and down logs, resulting from treatment activities, are expected to be similar to Alternative 1 in the immediate and short-term. In the long-term some increases in snags and down logs, over projections in Alternative 1, would be expected.

Benefits from thinning 384 acres of entire stands and portions of stands would be reduced with this alternative. Areas not thinned would not be reduced below a threshold of concern for white-fir in most cases and would retain a higher susceptibility to insect mortality. These stands would therefore be expected to contribute to higher snag and down log levels over time. The general silvicultural effects of not treating some stands are expected to be identical to Alternative 2; however the fact that some thinning would still occur on several thousand acres would provide some collateral benefits to non-treated stands in the area on a landscape basis.

Cumulative Effects for Modified Alternative 1

Cumulative effects from Modified Alternative 1 are expected to be similar to Alternative 1.

3.5 BOTANICAL RESOURCES

SPECIES ACCOUNT AND EXISTING CONDTIONS

Table 16 lists all Sensitive plant taxa identified on the Eldorado National Forest. No other Threatened, Endangered, Proposed, or Sensitive (TEPS) plant taxa have known occurrences or potential habitat on the Eldorado. Taxa that do not have potential habitat in the project area are not analyzed further in this document.

TABLE 16 HABITAT POTENTIAL OF THE BIG GRIZZLY FUELS REDUCTION AND FOREST HEALTH PROJECT ANALYSIS AREA FOR THE TEPS PLANT TAXA KNOWN OR SUSPECTED TO OCCUR ON THE ELDORADO NATIONAL FOREST.

Species	TES Status	Preferred Habitat	Potential for Project to Affect this Species
Three-bracted onion (*Allium tribracteatum*)	FS sensitive	Grows on gravelly lahar (volcanic mud flow soils) in chaparral and lower & upper montane coniferous forests from ~3,300 to 10,000 feet in elevation.	No
El Dorado manzanita (Arctostaphylos nissenana)	FS sensitive	Grows on highly acidic slate and shale soils and is often associated with closed-cone conifer forest from about 1,400 to 3,600 feet.	No
Big-scale balsamroot (Balsamorhiza macrolepis var. macrolepis)	FS sensitive	Grows in chaparral, vernally moist meadows & grasslands, grasslands within oak woodland, and ponderosa pine forest below 4,600 feet. Substrates include sandstone, serpentine, or basalt outcrops.	No
Upswept moonwort (*Botrychium ascendens*)	FS sensitive	Grows in lower montane coniferous forest, meadows, and seeps from 4,900 to over 7,500 feet in elevation.	No

Species	TES Status	Preferred Habitat	Potential for Project to Affect this Species
Scalloped moonwort (*Botrychium crenulatum*)	FS sensitive	Grows in fens, lower montane coniferous forest, meadows, seeps, and freshwater marshes from 4,900 feet to 10,500 feet in elevation.	No
Common moonwort (*Botrychium lunaria*)	FS sensitive	Grows in meadows, seeps, subalpine and upper montane coniferous forest from 7,450 feet to over 11,000 feet in elevation.	No
Mingan moonwort (Botrychium minganense)	FS sensitive	Grows in fens, lower and upper montane coniferous forest, meadows, and seeps from 4,900 to 6,750 feet.	No
Mountain moonwort (*Botrychium montanum*)	FS sensitive	Grows in lower and upper montane coniferous forest, meadows, and seeps from 4,900 feet to 7,000 feet in elevation.	No
Least moonwort (*Botrychium simplex*)	FS sensitive	Grows in seasonally moist meadows that dry out and springs in upper montane to subalpine habitats from 6,000 to 8,800 feet.	No
Pleasant Valley mariposa lily (*Calochortus clavatus* var. *avius*)	FS sensitive	Grows in openings in mixed conifer & ponderosa pine forest, usually on ridgetops and south-facing slopes from 2,500 to 5,600 feet. Grows on a variety of soils, typically with	No
Mountain lady's slipper (*Cypripedium montanum*)	**FS sensitive**	**Grows in moist areas and upland sites with northerly aspects, loamy soils and shade, from 3,500 to 5,700 feet (generally <5,000 ft).**	**Potential suitable habitat exists in units proposed for this project; however, no plants were located during surveys.**
Tahoe draba (*Draba asterophora* var. *asterophora*)	FS sensitive	Restricted to rocky ledges and talus slopes in subalpine and alpine habitats above 8,200 feet.	No
Cup Lake draba (*Draba asterophora* var. *macrocarpa*)	FS sensitive	Restricted to sandy slopes, rocky ledges, and talus slopes in subalpine and alpine habitats above 8,200 feet.	No
Subalpine fireweed (*Epilobium howellii*)	FS sensitive	Grows in moist to (seasonally) wet meadows, fens, and mossy seeps in subalpine coniferous forest, usually above 7,800 feet.	No
Tripod buckwheat (*Eriogonum tripodum*)	FS sensitive	Grows on serpentine soils in foothill and cismontane woodlands below 5,300 feet.	No
Parry's horkelia (*Horkelia parryi*)	FS sensitive	Grows on stony, disturbed, slightly acidic soils in open chaparral and cismontane woodland below 3,400 feet.	No
Hutchison's lewisia (*Lewisia kelloggii* ssp. *hutchisonii*)	FS sensitive	Grows in openings in upper montane coniferous forest, often on slate soils and on granitic and volcanic balds, from 4,800 to 7,000 feet.	No
Kellogg's lewisia (*Lewisia kelloggii* ssp. *kelloggii*)	FS sensitive	Grows on granitic and volcanic balds from about 5,000 to 8,000 feet.	No

Species	TES Status	Preferred Habitat	Potential for Project to Affect this Species
Long-petaled lewisia (*Lewisia longipetala*)	FS sensitive	Restricted to subalpine & alpine slopes or basins with deep snow accumulations, above 8,200 feet.	No
Saw-toothed lewisia (*Lewisia serrata*)	**FS sensitive**	**Restricted to steep, nearly vertical cliffs in inner gorges of perennial streams and rarely near seeps and intermittent streams. Grows between 2,800 and 4,800 feet in the American River & Rubicon River watersheds.**	**This species is present within the project area but not where activities are proposed.**
Yellow bur navarretia (*Navarretia prolifera* ssp. *lutea*)	FS sensitive	Grows in openings in or adjacent to mixed conifer forest or cismontane woodland on rocky ridgelines, saddles, or eroding ephemeral drainages from 2,300 to 5,000 feet. Often found on Ledmount soils.	No
Layne's ragwort *(Packera layneae*)	Threatened	Grows on rocky, gabbroic or serpentinitic soils in chaparral and cismontane woodland below 3,000 ft.	No or Grows sa
		and	
		Na.7(e)2.7(s)TJ/TT9341Tf5.06590TD.0015Tc[E000300036<0	
Stebbins' phacelia (*Phacelia stebbinsii*)	**FS sensitive**	**Grows on dry, open, rocky sites (bedrock outcrops, rubble or talus) on ledges or moderate to steep slopes and on damp, mossy inner gorges frsite4,800 , 8**	**0 0**

Factors responsible for the limited distribution of saw-toothed lewisia have not been identified. This plant may be a pre-Pleistocene relict that is now found on moist site refugia where summer drought conditions are more tolerable. Additional occurrences of saw-toothed lewisia may exist in the rugged canyons of the Rubicon and Middle Fork American Rivers.

Habitat for this perennial herb occurs on steep, metasedimentary bedrock outcrops with northerly aspects at elevations from 2,800 to 4,800 feet (USDA FS, 2004b). Plants are typically found in the inner gorges of perennial streams, although a few occurrences are found near seeps and intermittent streams. Relatively high humidity is often listed as a key habitat attribute, due to the frequent presence of the species in the "mist zone" of waterfalls. This correlation is in need of further study to determine whether the plants require higher ambient humidity or just greater access to summer moisture.

Threats include horticultural collecting and small hydroelectric power projects. One occurrence on the ENF has been extirpated, possibly through illegal collection of plants. The maintenance of the existing hydrology and habitat characteristics, as described above, in largely undisturbed conditions, would provide the necessary factors to achieve and sustain desired future conditions for saw-toothed lewisia.

STEBBINS' PHACELIA ***(Phacelia stebbinsii) –***
This annual herb is found only in the American River Watershed between the North and South Forks of the American River. Documented occurrences are on the Georgetown and Pacific Ranger Districts of the ENF. Other occurrences are on the American River and Nevada City Ranger Districts of the Tahoe NF.

Habitat for Stebbins' phacelia consists of dry, open, rocky areas on moderate to steep slopes, usually in association with bedrock outcrops, on ledges and slopes with rubble or talus, and occasionally in talus along roadsides (USDA FS, 2004b). Habitat also includes damp, mossy inner gorges near seeps, often associated with saw-toothed lewisia. Stebbins' phacelia is found on a wide variety of soil types, with the majority of ENF occurrences found on soils derived from metasedimentary rocks. This plant is found at elevations between 2,000 and 6,800 feet, in areas that on average receive 57 to 63 inches of precipitation a year. Although the distribution of Stebbin's phacelia is not strongly correlated with aspect, southerly aspects are more commonly recorded than northerly aspects. Threats include small hydroloelectric projects, road widening or other construction projects.

MOUNTAIN LADY'S SLIPPER ***(Cypripedium montanum)***
Mountain lady's slipper is an uncommon orchid in California although it has a wider range, both inside and outside the state, than do the other lady slippers that occur in California. In addition to California, it grows in Wyoming, Montana, Idaho, Oregon, Washington, Alaska, British Columbia, and Alberta. Its known distribution is not continuous within the Sierra Nevada or within its larger range. One occurrence is known from a private inholding in Amador County that falls within the Eldorado administrative boundary.

Mountain lady's slipper has adapted to multiple habitats, growing in both moist and dry conditions at elevations between 600 and 6,700 feet, although it is less common above 4,800 feet. It is found in mesic sites on deep, loamy soils within montane coniferous forests. It also grows in relatively dry conditions on hillsides with northerly aspects in mixed conifer forests.

Threats include pressures from population growth, collection, and habitat alteration through logging. In Siskiyou County, a pre-logging survey by the Forest Service found two populations, totaling 560 plants, in a planned clear-cut unit. A search of the area several years after it was harvested revealed only five plants on the edge of the clear-cut.

Watchlist Plants and Plant Communities
Two watchlist plant species are known from the project area. Fresno mat (*Ceanothus fresnensis*) occurs on or near the [illegible] logging

area. The ability to treat existing, expanding noxious weed occurrences would not occur at this time. The spread of noxious weeds would continue to adversely affect native vegetation.

The risk of a high severity or catastrophic wildfire occurring over a large portion of the project area is believed to remain high without fuel reduction treatments. In the event of wildfire, fire suppression activities likely would contribute to and increase the spread of invasive plant species. Fire line construction and other fire suppression activities could spread existing invasive species. New invasive species potentially would be introduced by fire suppression equipment. Post-fire road reconstruction and maintenance activities would spread existing and newly introduced invasive plant species.

Cumulative Effects for Alternative 2

There would be no cumulative effects to Sensitive plant species. Noxious weed species would continue to spread within the project area from road and trail maintenance, general use, and other activities on private and NFS lands. The ability to treat existing, expanding noxious weed occurrences would not occur at this time.

ALTERNATIVE 1 (PROPOSED ACTION)

Two sensitive plant species (saw-toothed lewisia and Stebbins' phacelia) are known to occur within the project area. The majority of the sites are within the inner gorges of Long Canyon, Wallace Canyon, and the downstream section of Big Grizzly Creek. Neither species occurs within or adjacent to units. Project activities would have no direct effect on these occurrences.

All units in which herbicide use is proposed are at least 0.5 horizontal miles from known sensitive plant occurrences. The risk of effect by drift or runoff to sensitive plants is extremely low and is discussed in more detail below.

The summaries on the risk characterization for glyphosate are from the SERA (2003a) risk assessment and project specific worksheets. For relatively tolerant, non-target species of plants, there is no indication that glyphosate is likely to result in damage at distances as close as 25 feet from the application site. For sensitive species at the upper exposure estimate the no-observed effect concentration (NOEC) begins to approach a hazard quotient (HQ) of 1 at offsite distances of 100 feet or less. It should be noted, however, that all of these drift estimates are based on low-boom ground sprays while this project proposes application of glyphosate by directed foliar applications using backpacks. Therefore little if any damage due to drift would be anticipated. Non-target terrestrial plants are not likely to be affected by runoff of glyphosate under any conditions. Plants that are sensitive to glyphosate have an NOEC of 0.035 lbs/acre. The estimated functional off-site application rate at 25 feet is 0.033 lbs/acre or roughly the NOEC for plants that are sensitive; therefore, little if any damage would be anticipated to R5 sensitive plant species.

The summaries on the risk characterization for triclopyr are from the SERA (2003b) risk assessment and project specific worksheets. The potential impact of off-site drift of triclopyr varies substantially with the application rate. The NOEC for plant species for triclopyr is 0.0039 lbs/acre. The estimated functional off-site application rate exceeds the NOEC at 100 feet (0.0058 lbs/acre) but drops below the NOEC by 300 feet (0.0023); therefore, there would be little risk to R5 sensitive plant species from drift of triclopyr.

The risk to sensitive plant species from runoff is considered in particular because saw-toothed lewisia and Stebbins' phacelia may be located in the mist from cascading streams. Because triclopyr is not expected to leave the units in which it is applied as a result of mitigation measures (Morales, 2009 updated 2010) and because all units in which triclopyr use is proposed are at least 0.5 horizontal miles from known sensitive plant occurrences, the risk to sensitive plant species from runoff of triclopyr would be extremely low.

The risk characterization for borax (SERA, 2006) states that "…non-target terrestrial plants do not appear to be at risk from exposure to borax at the maximum application rate used by the Forest Service. However, this risk assessment is based on data from relatively few terrestrial plant species. It is possible that more sensitive species exist and may be at risk for boron-induced toxicity." Based on this analysis and the distance between sensitive plant occurrences and borax application, there would be no risk to R5 sensitive plant species from stump application of borax as proposed.

Although surveys of potential habitat for saw-toothed lewisia, Stebbins' phacelia, and mountain lady's slipper have been completed, individuals or small clumps of sensitive plants may be overlooked (surveys can only positively state a species presence, not its absence). If surveys inadvertently overlook individual sensitive plants, these individuals may be destroyed or damaged by vehicles, harvesting equipment, the creation of fire lines, and project personnel. Because the majority of the project area where activities would occur does not support habitat for Stebbins' phacelia and saw-toothed lewisia, the likelihood of undiscovered plants of these species being harmed is extremely low. No other sensitive plant species were identified within the project area.

Indirect impacts to saw-toothed lewisia potentially could occur through changes to the hydrology of tributaries of Long Canyon or to Stebbins' phacelia through changes to the hydrology of Long Canyon, Wallace Canyon, Big Grizzly Canyon and their tributaries.

The transportation plan (Koltun, 2009) identified road reconstruction work that would occur along 13NY01 and 13N46C and road construction that would extend 13NY01. Reconstruction along these roads would consist of installation of rolling dips with no blading between dips and brushing; no new construction is proposed for 13NY01 (Walsh, 2010). There is a possibility that, in the short-term, road reconstruction on 13NY01 or 13N46C could move sediment into Wallace Canyon or Long Canyon, indirectly affecting saw-toothed lewisia and/or Stebbins' phacelia with sedimentation or by changes to the hydrology of drainages due to sedimentation. Saw-toothed lewisia, which is thought to be dependent on higher ambient humidity or summer moisture, would be most susceptible to changes in hydrology.

Surveys within the project area identified two high priority invasive species although an additional two species may be elevated to a higher priority rating when the proposed invasive plant species environmental analysis is completed. These species have the ability to outcompete native plant species for sunlight, water, and nutrients.

Soil disturbances can provide opportunities for the introduction and proliferation of noxious and other invasive plant species. As well as having the potential to quickly outcompete native plant species for sunlight, water, and nutrients, invasive species such as Scotch broom can form monocultures that alter native plant habitats. Seeds of these species can be carried into new areas on project equipment (e.g., feller-bunchers, masticators, road maintenance vehicles), and on workers' boots and clothing. Wind dispersed seeds, such as those of rush skeletonweed, would spread with or without project activities. The magnitude of the impact from noxious weeds is difficult to predict since it is contingent on the introduction of a noxious weed species into an area, an event which may or may not occur.

A major source of introduced weed seed is the import of gravel and rock used in road construction and reconstruction. Proposed road reconstruction (~57 miles), construction (1 mile), and maintenance (~28 miles) provide opportunities for the introduction of seeds and other plant propagules for new or existing invasive plant species. Road work also can spread seeds and propagules of existing weeds. Ground disturbance associated with road work such as blading provides an ideal medium (bare soil with sunlight) for the germination of introduced weed seeds.

Prescribed burning and fire line construction can benefit invasive species, if their seeds are present, through exposure of mineral soil and increases in soil nutrients and sunlight. An increase in invasive plants would have adverse effects to potential Sensitive plant habitat and to native vegetation. Timing or season of burning can determine short-term effects. Spring burning may reduce reproduction for that season. For some species, burning stimulates germination of seeds in the seedbank. Although burning may eliminate the aboveground growth of Scotch broom, it also may stimulate a flush of germination (DiTomaso and Healy, 2007).

Currently, high priority noxious weed species have a limited distribution within the project area. Design Features to reduce the risk of introduction and spread of invasive species include equipment cleaning and treatment of uninfested areas prior to areas with weed species. Weed monitoring following completion of the project would identify new and expanding noxious weed occurrences. New and expanding occurrences then would be treated by hand (e.g., pulling) or mechanical methods (e.g., lopping). The Scotch broom occurrence at unit 318-17 would be treated with glyphosate with possible follow-up treatment if hand pulling or pulling with a weed

wrench is not feasible or successful. If project activities at unit 329-15 stimulate germination of a Scotch broom seed bank, the plants would be treated with glyphosate if hand pulling is not feasible or successful. With glyphosate treatment, Scotch broom is not likely to expand due to project activities and the known occurrences may be reduced in size.

Appropriate herbicides for effective treatment of rush skeletonweed were not analyzed and therefore would not be used. In the absence of effective control methods, rush skeletonweed likely would continue to expand along Forest Road 14No8 and potentially into other areas.

Although design criteria for controlling the spread of invasive plant species would be implemented, it is likely that, given soil disturbance, road work, prescribed burning, fire line construction, and use of equipment within the project area, there is a low to moderate risk that invasive plant species would spread as a result of project activities.

Cumulative Effects for Alternative 1

The Big Grizzly project would contribute to cumulative effects to Sensitive plant species due to the potential, if small, for adverse indirect effects to Stebbins' phacelia and saw-toothed lewisia from road reconstruction and the potential to adversely affect mountain lady's slipper habitat.

The I &v`ÐÀ 0

>Tj/TT10f3689D0056Tc(hand)Tj/TT9/TT9f4.5509D0Tc603>.ectj/TT1/TT10wee1TT10f9f2Tj/TT9f3886D0Tc20003>Tj/T
Tj
Tj/TT10f3174D03Tc(10)6Tj/T

Alternative 1. The slight increase in canopy cover, could potentially help inhibit establishment of invasive plant species, although the effects likely would be negligible.

Cumulative Effects for the Non-Commercial Alternative

Cumulative effects to sensitive plant species would be the same as under Alternative 1. Cumulative effects to native vegetation from the spread of noxious weeds would be similar to Alternative 1. .

MODIFIED ALTERNATIVE 1

Direct effects to Sensitive plant species would be the same as under Alternative 1. Indirect effects would be similar to those under Alternative 1 although slightly reduced. Reducing the extent of project activities (e.g., timber harvest, prescribed burning) would reduce or eliminate the risk of introducing and spreading invasive plant species to some areas. Reducing the miles of road reconstruction by over 9 miles would reduce the risk of introducing and spreading invasive plant species within those areas.

Cumulative Effects for Modified Alternative 1

Cumulative effects to Sensitive plant species would be similar to those under Alternative 1. Modified Alternative 1 would contribute to cumulative effects to Sensitive plant species due to the potential, although small, for adverse indirect effects to Stebbins' phacelia and saw-toothed lewisia from road reconstruction and the potential to adversely affect mountain lady's slipper habitat. Compared to Alternative 1, there would be a slight reduction in the potential extent that Modified Alternative 1 contributes to the introduction or spread of invasive plant species.

3.6 FOREST SOILS

EXISTING CONDITIONS

SOIL DESCRIPTIONS

The digital soil coverage of the Eldorado National Forest was used to detail spatial extent of soils within the analysis area. Soils with similar physical, chemical, and pedological properties and similar responses to management are grouped into soil series within similar climatic regimes. Map units are the units of delineation on the digital soil survey layer and contain distinctive patterns of soil types (series) and topography. There are 17 different map units within the project area. Many map units can be considered similar for project level treatment activities.

The area has its geological beginnings as a Paleozoic inland sea. The sediment of this sea was uplifted, and intense folding and metamorphism followed. As a result, the Shoo Fly Complex, a nearly continuous belt of vertically tilted undifferentiated metamorphic rock was formed. Soils formed from these metasediments include the Mariposa, Jocal, and Maymen soil series. The extent of these soils is limited to 9 percent of the project area. These soils are generally shallow to very deep, loam surface texture grading to silt loam with depth, and have less than 35 percent rock fragments.

When the basement rocks of the metasediments were eroded during uplift of the Sierra Nevada range, granitic batholiths were exposed and weathered providing the parent material for Holland and Pilliken soil series which occupy approximately 0.2 percent of the area. These soils are deep, have coarse sand and loamy coarse sand textures, and have less than 35 percent rock. The mapped extent of these soils is very small and has not been observed within the project area.

The Mehrten Formation resulted from volcanic mudflow and lahars filling in existing drainageways carved into metamorphic basement rock and granitic batholiths. Soils formed in the Merhten formation include McCarthy, Crozier, Cohasset, Aiken, and Ledmount soil series. This is the most extensively mapped and observed soil group and occupy approximately 89 percent of the project area. Soils derived from Mehrten Formation parent material tend to be moderately deep to very deep with loam to sandy loam textures throughout the soil profile. These soils are generally skeletal with between 35 and 65 percent rock content particularly below 10 inches.

Glaciers scoured material along the crest of the Sierra Nevada mountain range and deposited the material as glacial moraines and erratics within the project area. The transported rocks are dominated by rounded granitic rocks. The only soil within the project area with morrainal parent material is the Zeibright soil series that comprise approximately 2 percent of the project area. These soils range from deep to very deep. Because of the grinding process of

glacial activity, textures tend to be coarse sandy loams. Rock content is predictably greater than 35 percent and as high as 80 percent.

Much of the nutrient base, herbaceous biomass, soil biological activity, and favorable infiltration characteristics occur in the A-horizon, or upper layer, of the project soils. Generally within the project area, this layer is approximately 15 to 20 inches thick in and unadulterated soil. Displacement of this surface soil could affect long-term soil productivity and infiltration characteristics.

EXISTING CONDITION OF FOREST SOILS

Non-Commercial Stands (Plantations) – All plantation units exceed acceptable soil loss. Degree of soil loss is difficult to quantify, but is at least 30 percent in all plantations. Soil loss is primarily a result of site prep for plantation activities. Past activities included windrowing and piling the surface soil horizons to remove shrub seeds. By comparing thicknesses and presence of differentiated soil horizons it appears up to 2-8 inches of soil was removed during site prep of the plantations. Gravel and cobble accumulations found on the surface in these units may also indicate soil removal by erosion.

All plantation units have some degree of deficiencies in effective soil cover. With effective soil cover values ranging from 40 to 100 percent. The soil porosity for all plantations has been reduced to unacceptable levels as measured by impeded root growth and platy soil structure. The extent of detrimental soil porosity ranges from 40 to 70 percent. Fine organic matter is also deficient in some part of all plantations with the range of fine organic matter 40 to 100 percent. Large woody debris was not consistently deficient.

Because soil porosity and effective soil cover are reduced on the plantations, soil hydrologic function is impaired. For slopes of 20 percent and greater and 40 percent cover, the erosion hazard rating is currently expected to be greater than 8, exceeding Forest Plan Standards and Guidelines.

Commercial Stands – No proposed commercial harvest stands were found to have soil loss exceeding Region 5 Soil Quality Standards. All commercial harvest units surpass minimum values for effective soil cover with effective soil cover values ranging from 90 to 100 percent. With 90 percent effective soil cover, the highest calculated erosion hazard rating in the project treatment area is 4.

No observed commercial units exceed unacceptable values for soil porosity reduction. Only one unit (318-1) was found at or near the threshold with 15 percent of the area with unacceptable soil porosity reduction.

SOIL EFFECTS ANALYSIS METHODS

The measures of soil productivity include soil loss, soil cover, soil porosity, and organic matter. The hydrologic function of a soil is dependent on soil properties such as soil texture, porosity, rock fragment content, depth, structure, and organic matter.

The Soil Survey of the Eldorado National Forest contains estimates for infiltration for soils within the project area. Although changes in infiltration are not directly measured for this project, examinations of changes to soil structure are a good indicator of changes to infiltration capacity.

For this analysis soil loss was predicted using the Watershed Erosion Prediction Program (WEPP model) (USDA Forest Service 2009). The WEPP model is a complex computer program that describes the processes that lead to erosion. These processes include infiltration and runoff; soil detachment, transport, and deposition; and plant growth, senescence, and residue decomposition. For each day of simulation, WEPP calculates the soil water content in multiple layers and plant growth/decomposition. The effects of tillage processes and soil consolidation are also modeled.

The soil hydrologic function was predicted using the Erosion Hazard Rating (EHR) system. The EHR system was designed by the California Soil Survey Committee (CSSC 1989) with the purpose of appraising the relative risk of accelerated sheet and rill erosion and provide an adjective rating associated with the likelihood and soil erosion to occur. The Eldorado National Forest LRMP requires erosion hazard ratings below 8 within 2 years of treatment. For the commercial stands, Erosion Hazard Ratings (EHR) were evaluated for the different soil groups, whereas the plantations are assumed to be supported by shallow soil based on soil morphology and impaired infiltration due to high levels of compaction.

The T-factor (Soil Survey Staff 1996) is used to estimate soil formation rates. The T-factor considers soil properties and climate to estimate soil formation rates.

The effects analysis for forest soils limits the analysis to the zone of influence as delineated by treatment unit boundaries**.**

EFFECTS

ALTERNATIVE 2 (NO ACTION)

With no action, no treatments or activities would directly affect soils within the project area. Because skidding and piling would not occur within the analysis area, additional compaction and displacement would not occur. Natural recovery of previously disturbed soil would continue in treatment units, however, soil nutrient cycling by micro flora and fauna could be suppressed by reduced understory vegetation caused by increasing canopy covers in some stands.

Without fuels treatments, the amount of fuel build-up would continue to increase and soil burning is expected as a result of high intensity fires. The risk of sedimentation increases as the risk of stand-replacement fire increases. In this case Erosion Hazard Ratings (EHR) would be high to very high.

Cumulative Effects for Alternative 2

Alternative 2 is not expected to result in cumulative effects.

ALTERNATIVE 1 (PROPOSED ACTION)

Activities included in the Proposed Action that would affect the soil resources include tree harvesting and removal using mechanized equipment, machine-piling excessive fuels, construction of fire lines in preparation of prescribed burning, and application of herbicides.

Direct soil disturbance would occur during all mechanized operations. Soil loss would primarily occur as displacement during the development and use of skid trails, landings, and fire lines. The amount of soil loss is dependent on the character of a site and the skill level of machinery operators, therefore the extent of soil loss directly caused by mechanized operations is difficult to predict. There would likely be a small increase in new skid trails and landings where existing skid trails and landings do not meet the needs of current objectives. Although the extent of new skid trail use is not exactly known, it is likely to contribute less than a 5 percent increase in detrimental soil conditions.

Adherence to Forest Standards and Guidelines and BMPs would limit the extent and severity of the effects to soils of new skid trails. Skid trail systems are typically designed to occupy less than 15 percent of a management area and would stay within the Forest Plan threshold value for soil disturbance of 15 percent. Because most units use existing roads and created skid trails as fire lines, significant displacement resulting from fire lines is not expected. Fire lines recently constructed in the Quintette Fuels Reduction Project near the town of Quintette were reviewed and shown to have the nutrient-rich A-horizon removed between 15 to 70 percent of the spatial extent of the lines. There are minimal differences in potential soil loss between soil groups. Both the volcanic and glacial soil groups have higher rock content and are slightly more resistant to soil displacement whereas the metasedimentary group has little rock to armor the soil surface.

Short term organic matter removal would be expected as a direct result of mechanical tree harvesting and skidding. Even though the natural stands currently have adequate to excessive litter cover, harvesting activities would result in displacement of litter cover. This displacement would be limited to skid trails, landings and limited areas within the harvest area. To reduce the threat of wildfire on the commercial stands, the thickness of organic matter would be reduced through mechanical methods and fire. On soils derived from both volcanic and sedimentary material, very little rock is found on the surface; therefore, nearly all effective soil cover would be organic matter. On the glacial group of soil, the high amounts of cobbles and stones would prevent excessive removal of organic matter.

Within non-commercial plantations, mastication and herbicide applications would increase soil cover. Mastication of plantations would bring the fine organic matter to acceptable levels. Mastication increases soil cover and organic matter as the masticator head disperses masticated material away from the machine. Herbicide treatments defoliate shrubs causing leaves to fall to the ground. The resulting leaf fall adds to the surface litter and increases soil cover. Like mastication in plantations,

herbicide treatments would likely lower EHR values due to increased soil cover but the magnitude of decrease depends on the amount of organic matter increase.

A reduction in soil cover resulting from prescribed fire would be expected. The burn plan for the Big Grizzly project is expected to leave 40 to 70 percent ground cover following activities. These cover values are similar to the minimum values for cover following mechanical activities. Shallow soils would have the greatest negative response to a reduction in soil cover. Because the soil is shallow, the herbaceous response to activities would be noticeably less than the other soil groups. Excessive soil cover removal from shallow soils would lead to noticeable increases in erosion. The only treatments planned in shallow soils are mastication of shrub fields. Mastication would increase ground cover mitigating erosion on these sites.

An estimated average of 15 trees per acre would be left in the gaps. Although trees left in gaps would provide soil cover input from seasonal needle fall, they would not provide enough material to replace what is lost to machine-piling and decomposition. Generally when forest canopy is inadequate to supply organic material in soils commonly found in the project area, herbaceous and shrub growth quickly supply the needed forest floor material. For the gap treatments, however, herbicide treatments would kill the shrub component of the understory. Although a single herbicide treatment alone would increase short-term soil cover, repeated herbicide treatments in conjunction with machine in the gap treatments would likely reduce effective soil cover, large woody debris, and fine organic material below Soil Quality Standards and LRMP standards until herbicide treatments are discontinued.

Commercial thinning of the natural stands is expected to decrease the overstory canopy cover and shift the understory component from being nearly absent to having a strong herbaceous understory. Within adjacent units where previous timber harvest created more open canopies and thinner surface organic layers, there has been a strong release of bear clover and honey suckle. The vigorous root growth of these two species contributes to compaction remediation, mitigates soil erosion, and contributes to carbon input to the soil. Indirect effects include increased carbon and nitrogen mineralization which may increase the long-term productivity of the soil and improve soil structure.

A temporary increase in soil erosion would be expected in treated areas. In both plantations and commercial stands, the greatest increase in erosion can be expected on landings and skid trails where most soil cover has been removed. Water control structures that are standard timber practices limit erosion to acceptable levels. For plantations, it is not possible to predict the increase in soil cover resulting from mastication but a resulting increase in soil cover would decrease the erosion rates compared to existing rates. For the commercial stands, soil cover is prescribed such that both soil loss and Erosion Hazard Ratings (EHRs) do not exceed threshold values.

Soil porosity reduction resulting from tree skidding would occur. The soils within the project area are sandy loams and loams and not prone to severe compaction. Most soil compaction occurs within three passes of log laden equipment; therefore, detrimental soil compaction is primarily found on skid trails. Without remediation, compaction on skid trails and landings can last for decades as confirmed by existing disturbance surveys and literature.

From existing condition disturbance surveys, there is a noticeable reduction in soil porosity resulting from mechanized operations. Compaction currently exists and is expected to increase on skid trails. Re-use of existing skid trails and standard harvest unit layout would limit cumulative disturbance to less than 15 percent of any one unit. Compaction resulting from single to double pass harvesting off skid trails is not expected to be detrimental. Between skid trails, porosity reducing activities would be limited to a pass associated with tree harvest and, potentially, a pass associated with machine piling. Existing organic material in the commercial stands would help mitigate compaction effects of treatments; however, as pore space is reduced, water and air movement into and through the soil profile is decreased, root growth is restricted and surface runoff and erosion is increased.

Short term organic matter removal would be expected as a direct result of mechanical tree harvesting and skidding. Even though the natural stands currently have adequate to excessive litter cover, harvesting activities would result in displacement of litter cover. This displacement would

be limited to skid trails, landings and limited areas within the harvest area. To reduce the threat of wildfire on the commercial stands, the thickness of organic matter would be reduced through mechanical methods and fire. On soils derived from both volcanic and sedimentary material, very little rock is found on the surface; therefore, nearly all effective soil cover would be organic matter. On the glacial group of soil, the high amounts of cobbles and stones would prevent excessive removal of organic matter.

In non-commercial plantations, no removal of organic matter would occur. Mastication of standing shrubs and small trees and the use of herbicides would increase the amount of organic matter with the quantity dependant on the amount of overstory masticated. Large woody debris is expected to remain unchanged due to design criteria specifying retention of large woody debris.

The soil textures and water-holding capacity of all the project soils are expected to promote strong herbaceous response. Increasing light to the soil by decreasing

stands not dedicated to skid trails and landings. The volcanic soils generally have a sandy loam soil texture. Most compaction from past activities on these soils is no longer evident in skid trails and landings. Planned activities would exceed threshold values for changes in certain soil properties such as detectable losses of soil productivity and soil hydrologic function on skid roads and landings.

The glacial deposit soils show no signs of disturbance due to the armoring the high rock content offers against disturbance. No commercial activity is planned on shallow soils because of the lack of site productivity on these soils. Although the shallow soils found in the mastication treatments tend to be highly disturbed, mastication activities are not expected to detrimentally disturb the soil.

Although there is concern for long-term soil productivity with whole-tree harvesting, mitigations for residual organic matter cover and forest canopy cover exceeding 40 percent continually adding biomass to the soil surface, nutrient capital should be maintained.

ALTERNATIVE 3

The effects to the soil resources are similar to the Proposed Action. Because the brush regrowth in plantations would be masticated instead of treated with herbicide, there would be a small additional amount of ground disturbance associated with the masticating equipment. Because mastication immediately converts standing biomass to ground cover as opposed to a slower process with herbicide application, there would be an immediate and substantial increase in the amount of soil cover with Alternative 3 as a result of the 2nd mastication treatment.

Cumulative Effects of Alternative 3

Cumulative effects of Alternative 3 would be similar to cumulative effects described in Alternative 1.

ALTERNATIVE 4

The effects to the soil resources would be the same as the Proposed Action except on those acres that would not be treated with Alternative 4. For those 913 acres not treated under Alternative 4, the effects would be similar to the No Action Alternative.

Cumulative Effects of Alternative 4

Cumulative effects of Alternative 4 would be similar to cumulative effects of Alternative 1 in treated stands. In the 913 acres deferred from treatment, cumulative effects would not occur.

ALTERNATIVE 5 (NON-COMMERCIAL ALTERNATIVE)

Because the extent of ground-disturbing activities would be the same as Alternative 1, the effects to the soil resources would be the same as Alternative 1.

Cumulative Effects for the Non-Commercial Alternative

Cumulative effects of the Non-Commercial Alternative would be similar to cumulative effects described in Alternative 1.

MODIFIED ALTERNATIVE 1

The effects to the soil resources are similar to Alternative 1, but with less extent and intensity with the reduced diameter limits, changing 60 acres of proposed thinning from below to prescribed fire only, removing 374 acres from treatment, and reduce burning on 78 acres.

Cumulative Effects for Modified Alternative 1

Cumulative effects of Modified Alternative 1 would be similar to the cumulative effects of Alternative 1 in treated stands. In the 374 acres deferred from mechanical treatment and the 78 acres of reduced prescribed burning, cumulative effects would not occur.

3.7 HYDROLOGY

EXISTING CONDITONS

WATERSHED DESCRIPTION

The analysis area for the hydrology resource includes all 7th field (HUC7) watersheds that intersect units of the Big Grizzly Fuels Reduction Project. A HUC 7 watershed, or sub-watershed, is typically less than 10,000 acres in size. All Big Grizzly Fuels Reduction Project HUC7 watersheds drain into the Rubicon River, either directly or via tributaries, and into Oxbow Reservoir. The Rubicon River forms the boundary between Placer County, on the northern side of the river, and El Dorado County to the south. Flow into the Rubicon River is controlled in part by

releases from Hell Hole Reservoir. The Rubicon River is a fifth order perennial tributary of the Middle Fork American River. Beneficial uses for the Middle Fork American River, from the source to Folsom Lake, include: municipal and domestic supply; irrigation; stock watering; power; contact and non-contact recreation; canoeing and rafting; cold freshwater habitat; potentially, warm freshwater habitat; cold water spawning; and wildlife habitat.[9]

Oxbow Reservoir and Hell Hole Reservoir are both listed in the Draft Final Clean Water Act Section 303(d)/305(b) Integrated Report for the Central Valley Region as impaired [10] due to mercury [11] (CVRWQCB 2009). The source of the mercury in Oxbow Reservoir is listed as resource extraction, while the source of the mercury in Hell Hole Reservoir is listed as unknown. Total Maximum Daily Loads (TMDLs) are expected to be completed for both reservoirs in 2021.

Most mapped aquatic features within Big Grizzly Project units are ephemeral or seasonal/intermittent channels that are tributaries of the larger drainages. Mapped special aquatic features are generally outside of project units.

Mean annual precipitation is generally between 50 and 60 inches within watersheds containing the project area. Elevations below 3,500 feet are expected to receive precipitation mainly in the form of rain, while elevations above 6,000 feet are expected to receive precipitation mainly in the form of snow. Portions of watersheds that lie in the transient snow or rain-on-snow zone, which occurs at elevations between 3,500 and 6,000 feet, tend to be more susceptible to watershed effects than portions of watersheds that receive precipitation primarily as rain or snow alone. All treatment areas occur within the transient snow or rain-on-snow zone.

HUC7 Watershed Descriptions

Lower Long Canyon – The Lower Long Canyon Watershed is bounded by the Rubicon River at the downstream end and the confluence of Long Canyon Creek and Wallace Canyon at the upstream end. The watershed is drained by Long Canyon Creek and its tributaries. Long Canyon Creek is a fourth-order perennial stream that flows west into the Rubicon River. The watershed is 5,556 acres.

Middle Long Canyon – The Middle Long Canyon Watershed is bounded by the confluence of Long Canyon Creek and Wallace Canyon at the downstream end and the confluence of the North and South Forks of Long Canyon Creek on the upstream end. The watershed is drained by Long Canyon Creek and its tributaries. Long Canyon Creek is a fourth-order perennial stream that flows west into the Rubicon River. The Placer County Water Agency diverts water from both the north and south forks of Long Canyon Creek approximately 0.7 and 3.0 miles upstream, respectively, from their confluence and the upper limit of the watershed. The watershed is 6,142 acres.

Lower Rubicon River – The lower boundary of the Lower Rubicon River Watershed is the confluence of the Rubicon River with the Middle Fork American River and the upper boundary is the confluence of the Rubicon River with Big Grizzly Canyon. The watershed is drained by the Rubicon River and its tributaries and is over 50% inner gorge with about 20% rock outcrops. Special aquatic features include the upper portion (approximately 14 acres) of Oxbow Reservoir which is located at the lower end of the watershed. The watershed is 8,261 acres.

Wallace Canyon – The Wallace Canyon Watershed is bounded by Nevada Point Ridge on three sides (southern, eastern, and western) and by an unnamed ridge along its northern side. The watershed is drained by Wallace Canyon Creek and its tributaries (named tributaries include North Wallace Canyon, South Wallace Canyon, and Little Wallace Canyon). Wallace Creek is a third-order perennial stream that

[9] Beneficial uses of water are designated by the Central Valley Regional Water Quality Control Board (CVRWQCB).

[10] Section 303(d) of the Clean Water Act of 1972 requires each state to identify water bodies that fail to meet applicable water quality standards. The U.S. Environmental Protection Agency approves the final 303(d) list from each state.

[11] Data supporting these listings was collected as part of the Middle Fork American River Project AQ11 Water Quality Technical Study, 2007 (FERC 2079) Placer County Water Agency (PCWA 2008). Fish were sampled for tissue analysis at one location in Hell Hole Reservoir and one location in Oxbow Reservoir. A total of 2 out of 10 samples at Oxbow Reservoir, and a total of 7 out of 11 samples at Hell Hole Reservoir, exceeded the USEPA fish tissue criteria for human health. The USEPA Fish Tissue Residue Criterion for methylmercury in fish is 0.3 mg/kg (0.3 ppm) for the protection of human health. This is the concentration that should not be exceeded based on a total fish and shellfish consumption weighted rate of 0.0175 kg fish/day. (CVRWQCB 2007)

(in acres). This gives the percent of the watershed covered by roads.

- For each land disturbance other than roads, the number of acres is multiplied by a number less than 1.0. The result (for each land disturbance) is then divided by the number of acres of the entire watershed. This gives the percent of the "equivalent roaded acres" in the watershed for each type of land disturbance.
- The values for equivalent roaded acres for all of the land disturbance activities are added together. The final number represents the percent of the watershed that is covered by the 'equivalent' of roads.
- The threshold of concern (TOC) is usually between 10 and 18 percent. That is, when 10 to 18 percent of a watershed is covered by the equivalent of roads, there is a "high risk" that increased peak flows of streams and sediment delivery to streams will occur. This does not mean these effects will occur precisely when the ERA reaches the TOC, or that an increase in peak flows and sediment delivery to streams will automatically result in a degradation of fish habitat or diminish the experience of recreationists. It is merely a warning that cumulative effects might occur.

Risk Categories -

- Low risk of CWE – ERA is less than 50% of TOC
- Moderate risk of CWE – ERA is between 50% and 80% of TOC
- High risk of CWE – ERA is between 80% and 100% of TOC
- Very high risk of CWE – ERA is greater than TOC

RIPARIAN CONSERVATION OBJECTIVES ANALYSIS (RCO ANALYSIS)

The Sierra Nevada Forest Plan Amendment Record of Decision (SNFPA ROD) of 2004 requires that a site specific analysis be conducted in order to determine the type and extent of activities that can occur within Riparian Conservation Areas (RCAs) adjacent to aquatic features. Specifically, the SNFPA ROD contains six Riparian Conservation Objectives (RCOs) that apply to activities within RCAs.

1. Ensure that identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Region Basin Plan, and the manner in which the standards and guidelines would protect the beneficial uses.
2. Maintain or restore: (1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fens, wetlands, vernal pools, springs; and (2) streams, including streamflows; and (3) hydrologic connectivity both within and between watersheds to provide for the habitat need of aquatic-dependent species.
3. Ensure a renewable supply of large down logs that (1) can reach the stream channel and (2) provide suitable habitat within and adjacent to riparian conservation areas (RCAs).
4. Ensure that management activities, including fuels reduction actions, within RCAs and critical aquatic refuges (CARs) enhance or maintain physical and biological characteristics associated with aquatic-and-riparian-dependent species.
5. Preserve, restore, or enhance special aquatic features, such as meadows, lakes, ponds, bogs, fences, and wetlands, to provide the ecological conditions and processes to recover and enhance the viability of species that rely on these areas.
6. Identify and implement restoration activities to maintain, restore or enhance water quality and maintain, restore, or enhance habitat for riparian and aquatic species.

EFFECTS

ALTERNATIVE 2 (NO ACTION)

With no action there would be no vegetation removal, no disturbance of existing soils and groundcover, and no tree planting due to project activities. Development of hydrophobic soils would not have the potential to occur as a result of prescribed fire. Streamflow would be expected to continue to depend to a large extent on precipitation variability, although water yield may change over time in response to changes in stand characteristics. In the event of a wildfire, an increase in water yield and storm-flow could occur as a result of vegetation loss and soil hydrophobicity.

Under this alternative, there would be no new sediment sources or potential for pesticide contamination created from project activities. Existing roads that cross drainages or that are in proximity to stream channels would be expected to continue to contribute sediment to drainages at

current rates. Current conditions of dissolved oxygen and water temperature would not be altered due to project activities, but could change in the event of a wildfire or other disturbance. Should a wildfire occur, increases in post-fire turbidity and sediment may occur from both the fire and fire suppression activities. Sediment yield as a result of fire varies widely, ranging from 3 pounds per acre to over 98,000 pounds per acre, with higher sediment yields typically associated with steeper slope gradients and higher intensity burning. Increases in nutrients and chemicals (such as nitrate, nitrite, sulfate, pH, total dissolved solids, and

standards and guidelines would not generally be expected to produce large areas of hydrophobic soils.

In Long Canyon, SF Long Canyon, Wallace Creek, Big Grizzly Canyon, the Rubicon River, in other project area drainages, and downstream in the Middle Fork American River and Oxbow Reservoir, increases in suspended sediment concentration and turbidity levels are expected to be minor or negligible. Increases are most likely to occur during and following large rainfall events and, should they occur, would not be expected to cause drainages to exceed state water quality standards for turbidity and sediment.

Most mapped streams within project units are first-order ephemeral drainages and a large number of these are not proposed for entry within the full extent of their associated Riparian Conservation Areas. Wallace Canyon Watershed, Rubicon River-Stony Creek Watershed, and Rubicon River-Leonardi Spring Watershed are currently the only watersheds where entry into a limited number of RCAs would occur.

The Protection Measures for the Riparian Conservation Areas (RCAs) are expected to minimize the amount of sediment delivered to drainages and special aquatic features within the Big Grizzly project area. Streamside vegetation removal or loss may result in warmer summer water temperatures due to increased solar radiation or colder winter water temperatures from loss of thermal cover. Sedimentation, and resultant turbidity, may also raise water temperature. Increases in water temperature typically result in lower dissolved oxygen concentrations. Within the Big Grizzly Project area increases in temperature of intermittent and perennial streams, and resultant changes in dissolved oxygen levels, are expected to be minor or negligible. Should increases occur, they would not be expected to cause project area drainages to exceed the state water quality standard for temperature.

Within all aquatic features of the Big Grizzly Project area, and downstream in the Middle Fork American River and Oxbow Reservoir, pesticide levels in water are expected to remain either below the detection limit or below the maximum contaminant levels for domestic water supplies.

Most project units treated with herbicide would receive treatment with glyphosate. Glyphosate tends to bind readily and strongly to soil particles, does not leach through most soil types, mostly (~90%) decomposes to its natural components within about six months, and does not bioaccumulate (SERA 1997, SERA 2003a). Monitoring results, based on over 150 surface water samples taken at locations in National Forests in California between 1991 and 2002, appear to indicate that glyphosate applied by ground application seldom reached surface water even with "no spray" buffer widths as narrow as 10 feet (Bakke 2001). The highest concentration of glyphosate measured by the US Forest Service in Region 5 since 1991 was less than 30 micrograms per liter (ug/L), while the Maximum Contaminant Level (MCL), as set by the Environmental Protection Agency, for glyphosate for human health is 700 ug/L. In addition, approximately 99 percent of the stream samples tested had concentrations less than the laboratory detection limit. The Minimum Detection Limit (MDL) for glyphosate is 1 to 25 ug/L. The few instances where glyphosate has been detected in surface water have almost always been traced to accidental spills directly into a stream, the intentional spraying of the stream surface, or the spraying of vegetation on the streambank or on gravel bars in the channel (Bakke 2001). Herbicide monitoring for glyphosate in surface water performed on the Eldorado National Forest between 1993 and 2007, showed no detection of glyphosate in any of 29 samples (Markman 2008).

Triclopyr binds weakly to soil particles and exhibits some leaching through most soil types (SERA 2003b). Triclopyr is only proposed for use in units 320-64, 320-79, 326-7, 326-8, 326-9, and 326-26. These units either contain no aquatic features or have mapped ephemeral channels as the only known aquatic features. All mapped ephemeral channels in these units are ephemeral portions of North Wallace Canyon or its tributaries and are within the Wallace Canyon Watershed. Based on current Site-Specific Protection Measures, a portion of North Wallace Canyon is presently the only mapped aquatic feature where application of triclopyr within the RCA would occur. Past monitoring has detected triclopyr in surface water with "no spray" buffer widths of 10-20 feet (Bakke 2001), however, application of triclopyr would not be allowed within 50 feet of the described portion of North Wallace Canyon. North Wallace Canyon in this location is discontinuous, topography is fairly flat, and groundcover is currently well over 75%, making potential for herbicide transport to the channel generally low. Additionally, herbicide monitoring for triclopyr in surface water performed

on the Eldorado National Forest between 1993 and 2007, showed no detection of triclopyr in any of 10 samples (Markman 2008). The Minimum Detection Limit for triclopyr is 0.3 ug/L. There are no EPA guidelines or standards for MDL for triclopyr.

The active ingredient in Sporax is Sodium tetraborate decahydrate. The agent of toxicological concern in this product is Boron. Boron is a naturally occurring element that is present in fresh surface waters in concentrations that generally range from 1 to 200ppb (USDA Forest Service 2006b). Borate compounds may be transported by percolation, sediment, or runoff, or adsorbed to soils. Based on the 2006 Forest Service Risk Assessment for Borax (Sporax), however, use of Sporax in the project area would not be expected to substantially contribute to concentrations of borax in water. Estimated peak concentrations of boron equivalents in surface water at an application rate of 1 lbs/acre of Borax, based on standard GLEAMS runs (which assume no buffers), are <0.00001 ppb in the modeled stream and 30 (6 to 100) ppb in the modeled pond (USDA Forest Service 2006b). Long-term average concentrations are <0.00001 ppb in the modeled stream and 14 (2 to 70) in the modeled pond (USDA Forest Service 2006). Design criteria in Table 5 that restrict harvest within RCAs would restrict Borax/Sporax use within RCAs. Additionally, the label states that Sporax is not to be applied directly to water or to areas where surface water is present; and that water should not be contaminated when disposing of equipment wash water or rinsate.

Adverse impacts to stream morphology within the Big Grizzly project area and downstream of the project, are expected to be minor or negligible. Minor or negligible increases in suspended sediment, turbidity, or streamflow are not expected to produce significant changes in morphologic characteristics of stream channels. Zones of no ground disturbance and "no spray" herbicide buffers included in the Design Criteria are expected to minimize direct disturbance of stream banks and changes in near-channel root structure.

A decrease in large woody debris to streams within the project area may occur, however, large woody debris remaining is not expected to be reduced below levels sufficient to maintain channel structure in intermittent drainages and ephemeral drainages with a riparian microclimate. Research has shown that approximately 96 percent of the large woody debris that reaches streams is from a ground distance of one site potential tree height of the stream channel (Reid and Hilton, 1998). Site specific protection measures for RCAs include no harvest zones that are expected to maintain an adequate renewable supply of large down logs within this area. A number of RCAs where future woody debris recruitment is questionable are not currently being considered for timber harvest. Additionally, large down wood and large rootwads would be added to Big Grizzly Creek in the NE ¼ of Section 22. Prescribed fire intensity high enough to substantially increase large woody debris to stream channels is generally not expected assuming burn plan objectives and Design Criteria are met.

Construction of new roads within the project area would be limited to two temporary roads that may cross mapped ephemeral channels within the Wallace Canyon Watershed, which would limit the potential for morphologic changes at crossings. Additionally, unblocking of culverts on Little Wallace Canyon, FSR 14N10H, and FSR 14N10C may help to reduce the risk of potential culvert failures, and potentially future adverse impacts to channel morphology at these sites.

Cumulative Effects for Alternative 1

CWE Risk for all watersheds except Wallace Canyon, Big Grizzly and Rubicon River-Leonardi Springs are expected to remain at a low level of concern after implementation of the Proposed Action. Slight increases in existing cumulative watershed effects (CWE) are anticipated in all drainages except Lower Long Canyon, Middle Long Canyon, Lower Rubicon River and South Fork Long Canyon Creek which are expected to maintain their current level of risk. Wallace Canyon and Rubicon River-Leonardi Springs would increase from low risk to moderate risk,

function of the type and size of tire or track that is used and the resultant ground pressure of the equipment. Due to the amount of surface roughness expected to be left on the ground following mastication, the potential for significant increases in runoff and sedimentation following mastication is expected to be low.

As herbicide use would not occur as part of the project, there would be no potential for herbicide use to affect aquatic features within the Big Grizzly project area and downstream in the Middle Fork American River and Oxbow Reservoir. There would, therefore, be no potential for changes in water purity or in channel stability to occur as a result of planned pesticide use or an accidental spill.

Cumulative Effects for Alternative 3

Cumulative effects would be similar to Alternative 1 except that the percent of the threshold of concern (TOC) risk of CWE would be reduced slightly in the watersheds with reduced treatment acres.

ALTERNATIVE 4

Effects within the Big Grizzly project area are expected to be similar to Alternative 1. Some units or portions of units that overlap RCAs within the Wallace Canyon and Rubicon River Watersheds that would receive treatment under Alternative 1 are not included in Alternative 4. The affected RCAs include an ephemeral tributary to South Wallace Canyon, an ephemeral tributary to the Rubicon River, and a portion of North Wallace Canyon. This would slightly reduce potential effects to these features from thinning, piling, and burning that may occur within the RCAs.

Cumulative Effects for Alternative 4

Cumulative effects would be similar to Alternative 1 except that percent TOC risk of CWE would be reduced slightly from Alternative 1 in the watersheds with reduced treatment acres.

ALTERNATIVE 5 (NON-COMMERCIAL ALTERNATIVE)

The effects from the Non-commercial Alternative are expected to be similar to what has been described for the Proposed Action except that there is a potential for reduced effects. Potential alteration of snow accumulation and melt rates may be reduced with the increase in approximately 8% canopy cover post harvest. Additional basal area retention of approximately 80 square feet, from retention of trees between 12 and 30 inches dbh may reduce potential increases in stream flow in some first order streams compared with the Proposed Action. Additional retention of trees between 12 and 30 inches may also reduce potential decreases in large woody debris to streams within the project area compared with the Proposed Action.

Cumulative Effects for Non-Commercial Alternative

Cumulative effects would be similar to Alternative 1.

MODIFIED ALTERNATIVE 1

Effects within the Big Grizzly Fuels Reduction and forest Health Project are expected to be similar to Alternative 1, with the following exceptions:

1) Some units that overlap RCAs within the Wallace Canyon Watershed that would receive treatment under Alternative 1 have been dropped or have reduced dbh limits in Modified Alternative 1. The affected RCAs primarily occur along ephemeral tributaries to South Wallace Canyon.

2) Potential effects associated with understory thinning and related activities would be reduced within watersheds.

3) Potential effects associated with prescribed burning and related activities would be reduced within the Rubicon River Ellicott Bridge and Wallace Canyon watersheds, and increased within the Big Grizzly Canyon and Rubicon River-Pigeon Roost watersheds.

4) As the 14N19 road would not be reconstructed, there would be no potential for road reconstruction to affect the intermittent drainage that it crosses.

Cumulative Effects for Modified Alternative 1

Cumulative effects would be similar to Alternative 1 except that percent TOC risk of CWE would be reduced slightly from Alternative 1 in the watersheds with reduced treatment acres.

3.8 ENDANGERED, CANDIDATE, AND SENSITIVE WILDLIFE SPECIES

3.8-A – AQUATIC WILDLIFE

AQUATIC SPECIES ACCOUNT AND EXISTING CONDITIONS

Within the Riparian Conservation Area (RCA), terrestrial plants and trees provide shade, regulate microclimates, and contribute pieces of large woody debris that create and enhance habitat complexity; riparian plant species also provide organic materials that serve as food for aquatic organisms such as macroinvertebrates. Because the riparian vegetation reduces solar radiation, precipitation, and wind speed, it has the potential to influence moisture and temperature regimes. Water temperature directly affects dissolved oxygen and has the potential to influence other aquatic habitat components such as pH.

Seasonal stream channels comprise a high percentage of the channel system in Sierran watersheds, and have the potential to contribute and/or control the input of sediment, water, woody debris, and nutrients to downstream reaches. The use of intermittent channels by aquatic and aquatic-dependent species depends primarily on the presence of water and distinctive riparian vegetation.

Table 17 lists those species that are Federally Listed Threatened, Endangered, Candidate or Forest Service Sensitive aquatic species, species, their preferred habitats, and whether, based on the activities the project proposes, the species has the potential of being adversely affected by any of the proposed activities. Species that may be affected by the activities proposed under this project are in bold type.

TABLE 17 THREATENED, ENDANGERED, OR SENSITIVE AQUATIC SPECIES THAT MAY BE PRESENT IN ELDORADO NATIONAL FOREST, THEIR PREFERRED HABITAT AND ELEVATION RANGE, AND THEIR POTENTIAL TO RESIDE IN THE BIG GRIZZLY FUELS REDUCTION AND FOREST HEALTH PROJECT AREA.

Species	TES Status	Elevation Range of Habitat	Preferred Habitat	Potential for Project to Affect this Species
California red-legged frog	**threatened**	**Below 1,525 m (5,000 ft)**	**Ponds and slow-moving streams**	**Big Grizzly Canyon has suitable habitat in Section 28. Project activities would be buffered by more than 300 feet, which includes potential dispersal habitat.**
Central Valley spring-run Chinook salmon	threatened	N/A	Central Valley delta and up rivers to man-made and natural barriers	None.
Central Valley steelhead	threatened	N/A	Central Valley delta and up rivers to man-made and natural barriers	None.
delta smelt	threatened	N/A	Sacramento-San Joaquin delta	None.
foothill yellow-legged frog	**FS sensitive**	**Below 1,830 m (6,000 ft)**	**High gradient streams with cobbles, riffles, and open areas**	**Suitable habitat exists in perennial and intermittent streams within the project area. However, project design would minimize sediment delivery to perennial stream channels.**
hardhead	FS sensitive	9-1,465 m (30-4,800 ft)	Sacramento-San Joaquin delta, S. Fork American River	Distance downstream from project boundary would not affect hardhead. Known to reside in the Rubicon River approx. 5 miles downstream from the project area.

Species	TES Status	Elevation Range of Habitat	Preferred Habitat	Potential for Project to Affect this Species
Lahontan cutthroat trout	threatened	N/A	High elevation and east slope streams and lakes	None. No known populations have the potential to be affected by the proposed project.
mountain yellow-legged frog	FS sensitive	Above 1,525 m (5,000 ft)	High elevation low-gradient streams and small ponds	None. No known populations have the potential to be affected by the proposed project. Outside of species' range.
northern leopard frog	FS sensitive	From sea level-2,135 m (7,000 ft)	Perennial streams and ponds	None. Incidental historical sightings for this species on Forest at Riverton and off-Forest in the Lake Tahoe Basin.
western pond turtle	**FS sensitive**	**Below 1,525 m (5,000 ft)**	**Ponds and slow moving streams**	**Suitable stream and nesting habitat exists in perennial streams within the project area.**
Sacramento winter-run chinook	endangered	N/A	Central Valley delta and up rivers to man-made and natural barriers	None.
Yosemite toad	FS sensitive	Above 1,950 m (6,400 ft)	High elevation wetland areas and meadows	None. No known populations have the potential to be affected by the proposed project. Outside of species' range.

FOOTHILL YELLOW LEGGED FROG –
The foothill yellow-legged frog was common in the Sierra Nevada historically; thus, almost every Sierran creek below 6,000 ft in elevation has the potential to be inhabited by this species. Foothill yellow-legged frogs tend to reside in perennial streams, although it is possible that they may be seen in seasonal streams when they have flowing water. There are 18 miles of perennial and 143 miles of seasonal streams within the project boundary, and 109 miles of perennial and 490 miles of seasonal streams within the two 6th field watersheds.

The nearest known sightings of foothill yellow-legged frog to the Big Grizzly Fuels Reduction and Forest Health Project are in the Rubicon River. Placer County Water Agency surveyed the Rubicon River in 2007 and found foothill yellow-legged frogs distributed on the Rubicon River from Oxbow Reservoir to above Ellicott's Bridge, and downstream from the confluence with the South Fork Rubicon River. It is suspected they also reside a mile or two up Big Grizzly Canyon and Long Canyon from the Rubicon River confluence. The nearest past foothill yellow-legged frog sighting is 100 feet from Unit 317-318, next to the Rubicon River.

There are approximately 10 miles of key suitable habitat where foothill yellow-legged frogs could reside within the project boundary. The inhabited stream reach where foothill yellow-legged frogs are known to reside, downstream from the project boundary in the Rubicon River is 16.7 miles. The project boundary is generally at least a half mile up these tributaries from the Rubicon River, but in Sections 23 and 26 it comes as close as 100 feet. The tributaries coming from the project area to the Rubicon River that may have enough perennial flow during the summer to provide suitable reproductive or dispersal habitat for foothill yellow-legged frogs are Wallace Canyon, Little Wallace Canyon, North Wallace Canyon, South Wallace Canyon, Long Canyon, and Big Grizzly Canyon.

There is thought to be a one or two mile limit to the foothill yellow-legged frog distribution up Big Grizzly Canyon from the Rubicon River. The closest unit (Unit 330-18) up Big Grizzly Canyon from the Rubicon River is 2 miles.

CALIFORNIA RED-LEGGED FROG –
Streams of the project area were visited for RCO analysis near treatment units during the fall of 2008 and fall of 2009 by the fisheries biologist and hydrologist. All streams near project units were visited and surveyed for aquatic species. No ponded areas were observed, nor any waterbodies with backwater areas. The field forms can be obtained at

the Supervisors Office. No California red-legged frogs were observed.

A GIS analysis of suitable California red-legged frog reproductive habitat below 5,000 feet elevation and within 1 mile of the Big Grizzly Fuels Project area did not find any pond habitat, although there are several stretches of low gradient stream habitat. These include 0.3 miles on Big Grizzly Canyon in Section 28, 0.5 miles on the Rubicon River at the southern project boundary, several 0.1 mile stretches of Long Canyon in Sections 7, 13, and 15, and 0.2 miles of North Wallace Canyon in Section 3 on private land.

Big Grizzly Canyon: Big Grizzly Canyon: Surveys to USFWS protocol were performed in 2005 on Big Grizzly Canyon, the only suitable low-gradient stream reach within the project area. These surveys were two day and two night surveys, and no CRLF were observed. The low gradient reach on Big Grizzly Canyon is approximately 1.18 mile long and was determined to have suitable habitat for CA red-legged frog breeding. It flows primarily through private land in Section 28, with a ¼ mile long reach on NF land. The stream habitat has slow moving water in pools from 2 to 3 feet deep with egg braces of overhanging small branches. The stream is very shaded with about 80-90 percent canopy cover. Brown trout are common. There are no California red-legged frog travel corridors within 1.25 miles between this suitable habitat and any other. California red-legged frogs may also take shelter in small mammal burrows and other refugia on the banks up to 328 feet from the water any time of the year and can be encountered in smaller, even ephemeral bodies of water in a variety of upland settings (Jennings and Hayes 1994; U.S. Fish and Wildlife Service 2002). Seasonal streams may be dispersal habitat from reproductive areas; movements between reproductive areas may occur for dispersal. There are no other reproductive sites for dispersing California red-legged frog to be moving to and from.

Rubicon River and Long Canyon: On the south end of the project, the Rubicon River flows within 300 feet of project units, and on the north end of the project, Long Canyon lies within 0.23 miles of the project. Previous surveys by Placer County Water Agency, in accordance with USFWS, determined that the Rubicon River and Long Canyon flow too fast during breeding and do not have slow backwater areas that would be suitable breeding habitat for California red-legged frog (PCWA 2010 and USDI 2008).

North Wallace Canyon: The low gradient area on North Wallace Canyon is on private land. The creek both upstream and downstream on National Forest land was surveyed in 2009 and it was seasonal, had areas of shallow water, and not suitable for California red-legged frog reproductive habitat.

The nearest past sighting of California red-legged frog was observed in Ralston Pond on Ralston Ridge in 2001 where an adult California red-legged frog was observed, approximately 3.8 miles northwest of the project. More recently, California red-legged frog sightings (1 adult and 1 juvenile) occurred during summer of 2009 in a tributary to Little Silver Creek and a tributary to Bear Creek. These California red-legged frog were thought to be dispersing from a suspected reproductive location, a pond on private land. These locations are approximately 7.5 and 9 miles southwest of this project.

California red-legged frogs have also been confirmed in the North Fork Weber Creek drainage on Bureau of Land Management land. Here egg masses and adults have been detected in Spivey Pond between 1998 to present. This pond is approximately 14 miles south of the project. A historic sighting occurred on Traverse Creek in 1975, approximately 11.2 miles west of the project.

WESTERN POND TURTLE –
Any perennial stream is considered suitable habitat at all elevations of the project. This includes 18 miles of perennial streams within the project boundary, and 109 miles of perennials within the two 6th field watersheds. Western pond turtles are very secretive and even when surveyed it is difficult to know whether the turtles that live there have actually been observed.

Western pond turtles, one of only two species of freshwater turtle native to west coast of the United States, are habitat generalists, occurring in a wide variety of permanent and intermittent aquatic habitats; however, they prefer to have pools nearby to escape from predators and basking sites such as large logs and boulders. Habitat needs can be varied; western pond turtles are not restricted to any certain type of habitat and could potentially be found in most streams below 5,000 ft in elevation.

Western pond turtle nests can be within approximately 1/3rd of a mile from a perennial streamcourse and are generally found on south and

southwest facing slopes with a slope angle of 15 degrees or less, adjacent to perennial streamcourses that are dominated by grasses and herbaceous annuals with few shrubs. A GIS analysis was performed using these criteria. It was determined that approximately 863 acres of potential terrestrial western pond turtle nesting habitat was located within the project boundary.

There is no known survey technique to positively identify western pond turtle nests. There was a past sighting in 1991 of a western pond turtle within the project on Little Wallace Canyon.

AQUATIC WILDLIFE CUMULATIVE EFFECTS METHOD

The cumulative effects analysis area for aquatic wildlife was analyzed as the Long Canyon Creek (31,367 acres) and Lower Rubicon River (42,065 acres) 6th field watersheds. For past project activities, the project area was primarily considered.

EFFECTS

ALTERNATIVE 2 (NO ACTION)

With Alternative 2 there would not be project activities that could cause reductions in future large woody debris recruitment as a result of tree removal in the RCAs. Where existing roads are causing erosion after storm runoff, these roads would not be repaired or reconstructed, therefore erosion to the streams would continue. By not implementing this project there would be no chance of an accidental spill of herbicides which could reduce algae, food for tadpoles, and aquatic vegetation affecting macroinvertebrates.

If a catastrophic wildfire over this landscape were to occur, the effects would likely be variable and depend on the burn severity. Streams could be filled with sediment, although potentially only for a short-term (generally less than 5 years), degrading and potentially making uninhabitable habitat for aquatic species. Amphibian responses to fire and associated habitat alterations are species-specific, incompletely understood, and variable among habitats and regions.

Riparian plant species possess adaptations to fluvial disturbances that facilitate survival and reestablishment following fires, thus contributing to the rapid recovery of many streamside habitats. Moist riparian areas burn cooler than the lower order stream environments, which burn more like the upslope areas (Fisk et al. 2004). The aquatic species in these lower order stream environments would likely be affected the most from a catastrophic wildfire.

Cumulative Effects for Alternative 2

Under Alternative 2 cumulative effects from ground disturbing actions, reduction in future large woody debris, and fungicide use from this project would not occur. If there was a catastrophic fire, then the cumulative effects would potentially be much greater with this alternative than with Alternatives 1.

ALTERNATIVE 1 (PROPOSED ACTION)

GENERAL EFFECTS

Land management activities such as fuels reduction and prescribed burning have a greater potential to adversely affect amphibians than other vertebrates because: (a) they use both terrestrial and aquatic habitats with cover requirements differing by life history stage; (b) their body temperature is not internally regulated; (c) they breathe through their skin extensively; and (d) they have low mobility. The degree to which individuals can be affected by land management activities depends largely on the intensity of these activities in and immediately adjacent to riparian areas.

A site-specific Riparian Conservation Objective analysis (Morales 2009 updated 2010) has determined that implementation of Aquatic Feature Protection Measures in the project Design Criteria would maintain riparian and aquatic system functionality. Therefore, physical structure of the stream channel and the riparian plant community would not be altered to the extent that habitat complexity would be reduced, potentially resulting in alterations to daily water temperature regimes or macroinvertebrate assemblages, and the amphibians that may live there. A slight increase in sediment delivery to stream channels in headwater stream channels after large rainfall events is not expected to alter pool depth or other stream characteristics due to the distance between the proposed treatment units. After the prescribed burn, it is not expected for any significant sedimentation to occur in the Rubicon River upon significant rainfall.

Depending on stream hydrology (e.g., depth, width, and flow), channel morphology (e.g., channel type

and substrate), aspect, and timing of the treatments, treatments have the potential to affect aquatic and aquatic-dependent species as well as riparian vegetation and floodplain functionality. Water temperature has an influence on the type, density, and distribution of aquatic species (e.g., macroinvertebrate aggregations and algal assemblages). Thus, depending on the amount of alteration, changes in riparian vegetative composition and structure that fall outside of the range of natural variability have the potential to influence daily water temperature regimes, affect macroinvertebrate assemblages, and affect aquatic species presence and reproduction. Studies show that much of the change in microclimate takes place within about one tree height of the streamcourse (Reid and Hilton 1998). The stream buffers provided in the Design Criteria are designed to prevent any effects to water temperature with aquatic systems in the project area..

Follow-up fuels treatments such as prescribed fires within the Riparian Conservation Area, would have the potential to adversely affect herpetofauna immediately adjacent to aquatic features, if present. Fire would be allowed to back down to the stream channel; however, backing fires in riparian areas generally move slowly and are of low intensity allowing herpetofauna to escape. Prescribed understory burning in riparian areas can cause sedimentation, however the flames typically extinguish before reaching the stream. Although it is possible some sedimentation from bare soil could result, it is expected to be very minor, and not contribute to downstream sedimentation of pools. . If the prescribed fire treatments were hot enough to consume the riparian vegetation near streams, warmer water temperatures could result. This is not expected to occur with the burn prescription designed for slow, cooler burning conditions.

Removal of hazard trees near streams can cause sedimentation from disturbed soil, and removal of ground cover. Removal of hazard trees near streams occurs very infrequently, and should not cause significant stream sedimentation unless the road travels in the RCA adjacent to the stream for quite a distance, and quite a few trees are removed, which is not anticipated to occur in this project.

Stream buffers for herbicide use and ground disturbing activities contained in the Design Criteria for the project should maintain the integrity of the existing riparian condition in the short-term (<25 years). If an herbicide spill occurred it could remove food for tadpoles for a season, which may affect that one year cohort of larvae. Any reduction in algae, which is food for tadpoles, would be expected to recover within a year. Macroinvertebrates living associated with the aquatic vegetation that could be affected by herbicides would also be expected to recover the following year from upstream recruitment and reseeding.

Herbicide treatments, including ground applications, have the potential to affect the aquatic environment and aquatic/aquatic-dependent species through contamination, misapplication (direct to the water surface), spray drift, precipitation-related overland flow, spill, and/or leaching or percolation into groundwater. Mobilization of herbicides would be dependent on a number of factors including relationship of the unit relative to seasonal and perennial channels, the amount of rain, the flow of the stream, the chemical used, and soil type.

Two factors determine the degree of adverse affects of herbicide application on aquatic and aquatic-dependent species: 1) the toxicity of the herbicide to an organism, and 2) the likelihood that an organism would be exposed to toxic levels of the herbicide.

Acute exposure is a measure of a chemical's effect based on an exposure for only a short period of time. Acute exposure can occur at a lethal (death) or sub-lethal level (inducing behavioral changes like decreased avoidance response). An accidental spill would constitute the greatest potential for an acute event. An accidental spill incident involving chemical transport, mixing, application, and storage would be very unlikely as procedures and requirements are designed to prevent such an event, and have been shown to be effective. Best Management Practices (USDA 2000) provide guidance for emergency spill procedures and are designed to minimize the magnitude of effect resulting from a spill.

In chronic and subchronic toxicity, the organism is subjected to continuous or repeated exposures at lower concentrations over a longer period of time. The response of the organism to the chemical may be slight or delayed, with effect manifested over a range of temporal scales, including the life span of the individual to multiple generations. These exposures are most likely if chemical was present in ground water and subsequently entered surface flow, or if rain events created overland flow and mobilized

residual herbicide from leaf surfaces or soil. Chronic and subchronic exposure can adversely affect individual growth or the function of certain organs, and can have systemic effects with neurological, immunological, endocrine function, reproductive, teratogenic (birth defect), carcinogenic, and mutagenic implications.

Potential roles of toxicants include: a) affecting the susceptibility of herpetofauna young to disease; b) retarding growth and development of herpetofauna young; c) affecting the ability of larvae to avoid predation; d) affecting the development of physiological, morphological, or behavioral processes in a manner that subsequently impairs the ability of the young for future reproduction; and e) directly causing mortality of young. Additionally, recent research on Ranid frogs indicates that standard toxicology testing for certain pesticides may underestimate the power of pesticides when combined with other stressors such as predators (Renner 2004). However, these issues are not well understood, and more studies are needed before the roles of environmental xenobiotics in amphibian declines are fully understood.

Chemical toxicities are expressed as LC50 values, in milligrams of the chemical per kilogram body weight. LC50 represents the lethal concentration which causes death in 50% of the subject animals. The no observable effect concentration (NOEC) is also typically displayed. Additive, multiplicative, or synergistic effects of herbicides with other risk factors have only recently begun to be studied among amphibians, and remain unstudied in foothill yellow-legged frogs. These types of effects are a result of exposure to a combination of two or more chemicals resulting in greater effects than the summed effects of exposure to the individual chemicals.

GLYPHOSATE – Studies on the effects of glyphosate indicate there is a low toxicity to aquatic organisms. Glyphosate readily adheres to soil particles in the soil and water and would be quickly bound onto them and not likely to be in concentrations to adversely affect amphibians. This adhesion quality and lack of mobility makes glyphosate the best herbicide to use for dry ephemeral drainages. When these drainages are rewet by rain at a later time after application, it is less likely for this herbicide to become resuspended into the stream or into the groundwater.

A separate dose-response assessment for amphibians was not conducted in the SERA (2003a) risk assessment. Most of the available toxicity data suggest that amphibians are no more sensitive to glyphosate than fish. For longer term exposures to glyphosate, the most relevant study remains the life cycle toxicity studies done in fathead minnow. In this study, (SERA 2003a) the NOEC was 25.7 mg/L. No effect on mortality or reproduction was observed at this concentration.

The sub-lethal studies on carp were conducted over 14-days of exposure to concentrations of 2.5, 5, 10 mg a.e./L. At 10 mg/L abnormal histopathologic changes were noted in the gills and liver. At 5 mg/L, abnormal histopathologic changes were noted only in the gills. These changes were accompanied by increased alkaline phosphates activity. While these effects cannot be directly associated with potential longer term effects on fish populations, the histologic changes in the gills and liver would be classified as adverse. While it is conceivable, based on this study that at least some transient histopathologic effects could occur at the NOEC was 25.7 mg/L, in terms of the risk assessment, the life cycle NOEC of 25.7 mg/L remains the most appropriate basis for risk characterization (SERA 2003a).

The dose-response assessment for fish is substantially complicated by information indicating that some fish species such as salmonids (which includes native trout) are more sensitive to glyphosate than other species of fish and by information indicating that some surfactants are very toxic to fish and may substantially increase to the toxicity of glyphosate to fish. The risk assessment (SERA 2003a) estimated a chronic NOEC of 2.57 mg/L for technical grade glyphosate in sensitive species of fish based on an observed NOEC value of 25.7 mg/L in tolerant species of fish. This is based on a relative potency method where acute effects to sensitive fish occurred at a dose that was 10 times lower than acute effects to more tolerant fish.

The site-specific risk assessment worksheets for glyphosate with an application rate of 4 lbs/acre, shows NOEC modeling results in hazard quotients (HQ) for fish of 36.3 in an accidental spill scenario. A Hazard quotient above 1 is considered to be a significant hazard for aquatic species. The highest hazard quotient at the non-accidental acute exposure for sensitive fish is 3.2. The highest hazard quotient

for chronic/longer term exposure for sensitive fish is 0.06.

There are no risk quotients for algae, which are food for tadpoles. Based on the studies described in SERA (2003a section 4.1.3.4 and Appendix 11) they conclude that (Page 4-41) "glyphosate appears to be about equally toxic to both algae and macrophytes." The Hazard Quotient NOEC modeling results for aquatic macrophytes are: 0.5 for the spill scenario, 0.04 for non-accidental acute exposure, and 0.0008 for chronic longer term exposures. There is no scientific basis that glyphosate causes specific toxic effects on the nervous system, immune system, or endocrine function (Durkin and Diamond 2002). An accidental spill could expose an aquatic organism to a possibly harmful dose of pesticides.

The Site Specific Risk Assessment for this project described a spill scenario in a pond that resulted with 14.4 mg/l concentrations of glyphosate. For juvenile frogs (Crinia insignifera) the 48-hour LC50 was 83.6 mg/l for glyphosate (Bidwell and Gorrie 1995). The LC50 is the lethal dose to kill 50% of the individuals. Therefore, a spill scenario would result in a low risk of direct effects to frog. Furthermore, the chance of a spill occurring is very low. The highest concern with aquatic species is the effect of glyphosate on algae which is food for the tadpole life stage of foothill yellow-legged frog.

TRICLOPYR – Triclopyr has been observed to cause behavioral (neurological) changes that may affect survivability in frog tadpoles when exposed to ¼ to ½ of lethal levels. This acute toxic level (LC50) for tadpoles is greater than 1.2 ppm. (Berrill et al. 1994). Triclopyr BEE, degrades in less than 1 day into the acid form of triclopyr, which is non-toxic. The half-life of triclopyr (acid form) is less than 2 days, and usually cannot be detected after 7 days. There is no scientific basis for asserting that triclopyr causes specific toxic effects on the nervous system, immune system, or endocrine function (Durkin and Diamond 2002). TCP is a major metabolite of triclopyr and is found in both soil and water. TCP is substantially more toxic in fish than triclopyr acid, with acute LC50 values in the range of about 2 to 10 ppm, similar to the toxicity of triclopyr BEE.

The site-specific risk assessment worksheets for an application rate of 2.4 lbs/acre, show hazard quotients for fish, based on NOELs. Any number over 1 is considered as being a significant hazard to these species. The upper exposure estimate for the accidental spill scenario results in a hazard quotient (HQ) of 848. The hazard quotient for fish under the upper exposure estimate for non-accidental exposure, without stream buffers was 77. The hazard quotient for fish under the upper exposure estimate for chronic and longer term exposure was 9.6. There is no data on amphibians in the risk assessment worksheets, therefore fish are be used as a proxy.

Algae is food for tadpoles, thus the effects to algae could have an indirect effect to amphibian tadpoles. Based on NOELs for algae, hazard quotients are 151 for the upper exposure estimate for the accidental spill scenario. The upper exposure estimate for algae for the scenario non-accidental exposure without stream buffers results in an HQ of 14. The upper exposure estimate for algae after chronic and longer term exposure results in an HQ of 1.7.

To reduce the risk that triclopyr would reach streams at levels that would result in effects to aquatic organisms, stream buffers were developed in the project design. USFS Region 5 monitoring results show that employing untreated buffers on streams reduces the rate of water contamination to near zero (USDA, 2001). Using these buffers for triclopyr, the expected contamination is expected to be at or below levels found in past water monitoring. Such a level of water contamination with triclopyr would represent a low risk of adverse effects to fish and amphibians.

SPORAX - Very little information is available on the effects of borax to amphibians. A single study in larval leopard frogs exposed to borax for 7.5 days reports an LC50 of 47 ppm B, with an estimated NOAEC (for mortality) of 1.0 ppm B and an estimated LOAEC (for mortality) of 5.0 ppm B (Birge and Black 1977). Thus, toxicity of borax to leopard frogs appears to be relatively low. Results of a study in wood frog, Jefferson salamander, spotted salamander, and American toad show that boron concentrations of 50 and 100 mg B/L caused a dose-related decrease in proportion of eggs hatching in American toad, while hatching was unaffected in the other three species (Laposata and Dunson 1998). In this same study, a dose-dependent increase in proportion of deformed larvae was observed in wood frog, Jefferson salamander, and spotted salamander (not assessed in American toad).

Standard chronic exposure studies on the effects of borax or boric acid in fish were not identified in the

literature; all of the available data are from a single study on the effects of borax on rainbow trout, channel catfish, and goldfish (Birge and Black 1977). Results of this study show a similar degree of sensitivity for the three species tested. The lowest estimated NOAEC (for mortality) of 0.5 mg B/L was reported for goldfish and the highest estimated NOAEC (for mortality) of 1.0 mg B/L was reported for rainbow trout and channel catfish. NOAEC values were estimated based on tabular results reported in the study. Since different exposure times were used for each of the three species tested (up to 28 days for trout, 9 days for catfish, and 7 days for goldfish), it is difficult to identify a most sensitive and a most tolerant species for longer-term exposure. To assess the risk of longer-term exposures of fish to boron, the NOAEC of 0.5 mg B/L in goldfish will be used to represent the most sensitive species and the NOAEC of 1.0 mg B/L in rainbow trout and channel catfish will be used to represent the most tolerant species.

For aquatic microorganisms, the 72-hour NOAEC values range from 0.3 mg B/L in Entosiphon sulfacum, a flagellate, to 291 mg B/L in Pseudomonas putida (Schoberl and Huber 1988, as cited in WHO 1998). For this risk assessment, these NOAEC values of 0.3 mg B/L and 291 mg B/L are used to assess the consequences of both acute and longer-term exposures for sensitive and tolerant species of aquatic microorganisms.

SILICONE/MODIFIED VEGETABLE OIL BLEND SURFACTANTS (SYL-TAC® OR EQUIVALENT) – There is little information in the scientific literature on effects of seed oils and silicone-based surfactants on aquatic organisms. There is some information on a brand name, Syl-Tac®, which is a blend of vegetable oils and silicone-based surfactants. In (USDA Forest Service, 2007), the LC50 for rainbow trout and daphnia was reported as >5 mg/l after 96 hours. No studies on amphibians with Syl-Tac® were found. Therefore, it is unknown what effect these may have on these aquatic species.

There is no indication that silicone/modified vegetable oil blend is carcinogenic or mutagenic and there is very little information regarding the environmental fate of silicone/modified vegetable oil blend. Thus, no reasonable inference on the potential risk to aquatic species resulting from the chronic exposure to silicone/modified vegetable oil blend can be made (USDA Forest Service, 2003).

COLORFAST® PURPLE – There is no data on toxicity or LC50s of amphibians nor any aquatic species from colorfast purple exposure or its colorant, Basic Violet 3. Based on what is known regarding carcinogenicity of Basic Violet 3 to mice and rats, it can be assumed that at least similar if not more dramatic effects would occur to amphibians, which have more easily permeable skin.

Synergism

Surfactants, by their very nature, are intended to increase the effect of a pesticide by increasing the amount of pesticide that is in contact with the target (by reducing surface tension). This is not synergism, but more accurately is a reflection of increased dose active ingredient of the herbicide into the plant. Although there is not much data in the technical literature, the references included in Bakke (2007) indicate a lack of synergistic effects between surfactants and pesticides.

SPECIES SPECIFIC EFFECTS

FOOTHILL YELLOW-LEGGED FROG –

Since foothill yellow-legged frogs reside close to the streams, the stream buffers should prevent direct effects from crushing. Stream buffers for ground disturbing activities contained in the Design Criteria should maintain the integrity of the existing riparian condition in the short-term (<25 years). Any increase in the amount of sediment delivered to streams by ground disturbing activities would likely be only slight and the restoration work to close a road and add large wood to a section of Big Grizzly Canyon that is currently degraded would help to improve aquatic habitat in these areas.

Exposure to foothill yellow-legged frogs from herbicides is not expected, since stream buffers would be adhered to during implementation activities. Additionally, stream flow would be expected to dilute and flush downstream any slight herbicide amounts that may enter the streams. If an accidental spill were to occur, it could reduce algae (food for tadpoles) and aquatic vegetation affecting macroinvertebrates (food for adults). If herbicide entered slower water areas where foothill yellow-legged frogs are present, they could become directly affected by concentrated exposure to herbicides.

CALIFORNIA RED-LEGGED FROG –

Project activities would not occur closer than typical foraging distance of 300 feet in California red-legged

frog suitable perennial stream habitat, and pesticides would not be applied within 500 feet in their suitable habitat. The fuels and restoration activities of this project have buffered suitable habitat by a mile both upstream and downstream, using the SNFPA buffers as described in the Biological Opinion (USDI 2003). Direct effects are not likely to adversely effect any California red-legged frogs with the stream buffers from suitable habitat. It is not likely that sediment delivery to neither streams nor herbicides would result in degradation of aquatic habitat with the proposed stream buffers and implementing the Best Management Practices (Morales 2009 updated in 2010).

WESTERN POND TURTLE –
The amount of GIS mapped western pond turtle habitat in the project units (135 acres) lies primarily along Big Grizzly Canyon and Little Grizzly Canyon. Units that are within 150 feet from perennial streams are more likely to have western pond turtle nests that could be affected by heavy equipment. Little Grizzly Canyon is seasonal, therefore less likely to be used for nesting habitat. The most likely area in the project to be used by western pond turtles for nesting is the 150 foot riparian buffer of Unit 330-18 on perennial Big Grizzly Canyon, which consists of 71 acres. None of the proposed and existing landings are in western pond turtle nesting habitat.

Western pond turtles and their nests could be affected by the project activities in the following ways:

- Heavy equipment for temporary road building, road reconstruction, tree harvesting, masticating, or tractor piling could crush individual western pond turtles or their nests.
- Prescribed burning could burn adult western pond turtles, and may overheat eggs in their nests.

Individual western pond turtles (usually males) may have large home ranges and may wander within a given watercourse on a regular basis. Western pond turtle nests have been found as far as a quarter mile from the stream in open sunny areas on hill slopes, generally with a south to southwest facing aspect, although usually they are within 150 feet of the stream. Plantations or skid roads could provide an ideal location for a western pond turtle to lay its eggs, especially those located on south facing slopes.

It has been stated by USFS soil scientist, Chuck Mitchell, that the eggs within the nests would be far enough below the ground that they would not be burned in a prescribed burn, although this has not been studied. Adults could be subject to being burned by prescribed fire in the spring when traveling to lay eggs, or in the fall when overwintering. It is expected that adults are at risk of being crushed by heavy equipment during any month but August. Based on the natural history of the western pond turtle, there is a risk for disturbance to western pond turtles or their nests essentially year-round.

Based on the natural history of the western pond turtle, there is a risk for exposure of pesticides to western pond turtles or their nests at practically any time of year that spraying may occur. Western pond turtles moving on land, as well as their nests, could be exposed to herbicide through direct spray, or from contact with contaminated vegetation. Surrogate species are used conservatively when studies have not been performed on pesticide effects to species. Using the fish or amphibian studies for western pond turtle should be protective when in an aquatic habitat. For terrestrial habitat, effects to small mammals are used.

For the direct spray and contaminated vegetation scenarios, a small mammal is used as a surrogate species. The 100% direct spray analysis is used as a worst case scenario. For glyphosate and triclopyr, these scenarios yielded a hazard quotient less than 1, below the level of concern. It is unlikely that 100% of herbicide spray would be absorbed through the skin as western pond turtle skin is not as permeable as amphibians, and they have a hard shell over a majority of their bodies. The likelihood of a turtle being sprayed is very small, as no western pond turtles have been observed in the project area, and it is likely that an applicator would see a western pond turtle before being sprayed. Somewhat more likely, a western pond turtle could travel through an area that was recently sprayed and make contact with the herbicide on its tough skin. The absorbed dose resulting from contact with contaminated vegetation is assumed to be 1/10 that associated with comparable direct spray scenarios. Thus, hazard quotients associated with contact with contaminated vegetation would be less than the direct spray scenario. Since Borax is not a spray, the direct consumption analysis was used; this hazard quotient was also below 1 and below the level of concern (USDA 2006b).

There is a potential for herbicides to be in contact with western pond turtle nests, although the possibility of this occurring is unusual. Nests are 7-12 cm below the surface, and eggs are hard shelled (Ernst and Lovich 2009). At this depth it is expected that herbicides would only reach the nest underground if there was a heavy rainfall after spraying, saturating the soil resulting with deeper infiltration (Nicita, personal comm. 2010). The only studies on eggs being exposed to chemicals refer to chemicals within eggs as a result of food being eaten by the female laying the eggs. Other studies describe endocrine effects on hatchlings caused by pesticides organochlorine, chlordane, trans -Nonachlor, or p,p'-DDE, which are not being proposed in this project. The pesticides proposed in this project are not known to cause interference with endocrine hormones on any species.

Cumulative Effects for Alternative 1

Due to the uncertainty regarding future anthropogenic disturbance in the affected watershed, the temporal scale for this analysis is limited to approximately 5 years. Any timber activities being planned in the future by the USDA Forest Service would follow the standards and guidelines established under the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2004a). Under these standards and guidelines, the effects of future sales in the project area are expected to maintain and restore the species composition and structural diversity of plant and animal communities in riparian areas and promote the growth of larger trees that would eventually contribute large down woody debris to the Riparian Conservation Areas sooner than would have otherwise occurred. Implementing Best Management Practices (BMPs) would help eliminate effects to stream channels from herbicide treatments. Alternative 1 of the Big Grizzly Fuels Reduction and Forest Health Project may impact individuals, but is not likely to cause a trend toward Federal listing or a loss of viability for the foothill yellow-legged frog.

Combining the cumulative effects from other activities in the watersheds of the project area and historic large-scale effects to the species over time may possibly explain the absence of California red-legged frogs. Alternative 1 of Big Grizzly Fuels Reduction and Forest Health Project may affect, but nit likely to adversely affect the California red-legged frog.

It is not likely that implementation of this Project would exacerbate past, present, or future affects to western pond turtle populations or habitats because Design Criteria including RCA buffers would minimize adverse affects to aquatic habitats resulting from sediment delivery to stream channels, or possible crushing or burning of western pond turtles from project activities near Big Grizzly Canyon. Alternative 1 of the Big Grizzly Fuels Reduction and Forest Health Project may impact individuals, but is not likely to cause a trend toward Federal listing or a loss of viability for the western pond turtle.

ALTERNATIVE 3

Effects from Alternative 3 are expected to be the same as those described for Alternative 1 for thinning, mastication, piling, pile burning, and prescribed burning. By not including herbicide use in the implementation of this project there would be no chance of an accidental spill of herbicides which could reduce algae, food for tadpoles, and aquatic vegetation affecting macroinvertebrates.

Cumulative Effects for Alternative 3

Alternative 3 of the Big Grizzly Fuels Reduction and Forest Health Project may impact individuals, but is not likely to cause a trend toward Federal listing or a loss of viability for the foothill yellow-legged frog. Alternative 3 of Big Grizzly Fuels Reduction and Forest Health Project may affect, but nit likely to adversely affect the California red-legged frog. Alternative 3 of the Big Grizzly Fuels Reduction and Forest Health Project may impact individuals, but is not likely to cause a trend toward Federal listing or a loss of viability for the western pond turtle.

ALTERNATIVE 4

Alternative 4 may cause less potential downstream sedimentation from project activities over Alternative 1 by reducing treatment in RCA associated with the 820 acres removed from analysis for mechanical treatment. Having 93 fewer acres prescribed burned would reduce the number of acres where fire burn in riparian vegetation. It would also reduce potential soil and vegetation disturbance within and adjacent to stream channels resulting in sediment transport to streams.

With less acres of treatment for prescribed burning, any potential effects to the riparian areas or stream channel system, including connectivity for aquatic

species, would be less likely. The probability of a disruption of the stream channel-floodplain-riparian vegetation-upland vegetation continuum and functionality and reduction in upstream-downstream riparian connectivity would be lower. The potential for individual mortality due to exposure of foothill yellow-legged frog or western pond turtle to prescribed fire would be reduced. There would be less of a potential for a reduction in reproduction due to excessive amounts of sediment covering egg masses to occur.

Cumulative Effects for Alternative 4

Under Alternative 4, cumulative effects from ground disturbing actions from this project would be similar to Alternative 1. There may be slightly less possibility for cumulative effects to foothill yellow-legged frog from the implementation of the project than Alternative 1 as a result of fewer acres treated.

Alternative 4 may impact individuals, but is not likely to cause a trend toward Federal listing or a loss of viability for the foothill yellow-legged frog. Alternative 4 may affect, but would not likely adversely affect the California red-legged frog. Alternative 4 may impact individuals, but is not likely to cause a trend toward Federal listing or a loss of viability for the western pond turtle.

ALTERNATIVE 5 (NON-COMMERCIAL ALTERNATIVE)

Effects from the Non-Commercial Alternative are expected to be similar to those described for Alternative 1. Reducing the diameter limit of trees proposed for removal allows the larger trees to remain as potential future large woody debris to the stream.

Large trees falling in the stream improve aquatic habitat complexity creating more available habitat areas and escape cover for foothill yellow-legged frog and western pond turtle. Since California red-legged frog are not expected to reside in the project area or downstream within any aquatic influence of this project, this alternative would result in the same effects as the Proposed Action.

Cumulative Effects for the Non-Commercial Alternative

Cumulative effects from the Non-Commercial Alternative are expected to be similar to those described for Alternative 1. The Non-Commercial Alternative may impact individuals, but is not likely to cause a trend toward Federal listing or a loss of viability for the foothill yellow-legged frog. The Non-Commercial Alternative may affect, but would not likely adversely affect the California red-legged frog. The Non-Commercial Alternative may impact individuals, but is not likely to cause a trend toward Federal listing or a loss of viability for the western pond turtle.

MODIFIED ALTERNATIVE 1

Effects to treatment areas not modified with this alternative are addressed in Alternative 1. In areas with reduced diameter limits, larger trees would remain as potential future large woody debris to the stream where they would have been harvested within RCA widths with Alternative 1. Large trees falling in the stream improve aquatic habitat complexity creating more available habitat areas and escape cover for foothill yellow-legged frog and western pond turtle life stages. The change in some areas of thinning from below to prescribed fire only treatment units reduce potential for sedimentation due to compaction of ground by heavy equipment.

Cumulative Effects for Modified Alternative 1

Under Modified Alternative 1, cumulative effects from implementing this Alternative would be less than Alternative 1. Other non-project-related cumulative effects are addressed under Alternative 1. The Modified Alternative may impact individuals, but is not likely to cause a trend toward Federal listing or a loss of viability for the foothill yellow-legged frog. Modified Alternative 1 may affect, but would not likely adversely affect the California red-legged frog. The Modified Alternative 1 may impact individuals, but is not likely to cause a trend toward Federal listing or a loss of viability for the western pond turtle.

3.8-B - TERRESTRIAL WILDLIFE

SPECIES ACCOUNT AND EXISTING CONDITION

Table 18 lists those species that are Federally Listed Threatened, Endangered, Candidate, or Forest Service Sensitive terrestrial species, their preferred habitats, and whether, based on the activities the project proposes, the species has the potential of being adversely affected by any of the proposed projects.

Species that may be affected by the activities proposed under this project are in bold type.

TABLE 18 THREATENED, ENDANGERED, OR SENSITIVE TERRESTRIAL SPECIES THAT MAY BE PRESENT IN ELDORADO NATIONAL FOREST, THEIR PREFERRED HABITAT, AND THEIR POTENTIAL TO RESIDE IN THE BIG GRIZZLY FUELS REDUCTION AND FOREST HEALTH PROJECT AREA.

Species	Status	Preferred Habitat	Potential for Project to Affect this Species
Valley Elderberry Longhorn Beetle *(Desmocerus califronicus dimorphus)*	Threatened	Elderberry plants greater than 1" at ground level within 100' of project. Below 3,000 feet elevation (USDI Fish and Wildlife Service 1999).	Project does not occur in known or suspected home range
Bald Eagle *(Haliaeetus leucocephalus)*	FS Sensitive	Habitats or areas identified in Draft Bald Eagle Management Plan (USDA Forest Service 1999, 2003, 2004b).	Project does not affect suitable habitat
Peregrine Falcon (*Falco peregrinus*)	FS Sensitive	Cliff sites identified as potential nesting habitat (Wilderness Research Institute 1980, USDA Forest Service 2004b).	Project does not affect suitable habitat. Project does not affect specific habitat features important to the species.
California Spotted Owl (*Strix occidentalis occidentalis)*	**FS Sensitive**	**Mature forested habitats with large trees, dense canopy cover with at least two canopy layers, and abundant snags and down logs (CWHR size class 4, 5, and 6; vegetation density greater than 50%) (USDA Forest Service 2001, 2004b). Areas adjacent to Protected Activity Centers or individual activity centers (USDA Forest Service 2003).**	**Project activities proposed in suitable and identified habitat.**
Great Gray Owl *(Strix nebulosa)*	FS Sensitive	Large meadows and meadow complexes greater than 15 acres in size and forested stands within 1,000 meters of meadows mapped as potential habitat in the Forest-wide GIS layer (USDA Forest Service 1999c, 2003).	Project does not affect suitable habitat. Project does not affect specific habitat features important to the species.
Northern Goshawk *(Accipiter gentilis)*	**FS Sensitive**	**Mature forested habitats with large trees, dense canopy cover with at least two canopy layers, and abundant snags and down logs (CWHR size class 4, 5, and 6; vegetation density greater than 40%) USDA Forest Service 2001, 2004b). Areas adjacent to Protected Activity Centers, or individual activity centers. (USDA Forest Service 2003)**	**Project activities proposed in suitable and identified habitat.**
Willow Flycatcher *(Empidonax traillii)*	FS Sensitive	Broad open meadows or riparian areas greater than 15 acres with a willow component greater than 6.5 feet in height mapped as potential habitat in the Forest-wide GIS layer (USDA Forest Service 1999c, 2003)	Project does not affect suitable habitat. Project does not affect specific habitat features important to the species.
Pacific Fisher *(Martes pennanti)*	**Candidate for Listing**	**Forested habitats below 8,500 feet elevation, with fairly dense canopies and large trees, snags, and down logs. Hardwoods may also serve as an important habitat component (USDA Forest Service 2001, 2004b).**	**Project activities proposed in suitable habitat.**
American Marten *(Martes Americana)*	**FS Sensitive**	**Forested habitats above 5,500 feet elevation, with large diameter trees, snags, and down logs, moderate-to-high canopy closure, and an interspersion of riparian areas and meadows. (USDA Forest Service 2001, 2004b)**	**Project activities proposed in suitable habitat.**
Sierra Nevada Red Fox *(Vulpes vulpes necator)*	FS Sensitive	Red fir, Lodgepole Pine, meadows and riparian areas, and alpine and subalpine habitats above 5,000 feet elevation (USDA Forest Service 2001).	Project does not affect suitable habitat.

Species	Status	Preferred Habitat	Potential for Project to Affect this Species
California Wolverine *(Gulo gulo luteus)*	FS Sensitive	Alpine and subalpine habitats within Desolation Wilderness.	Project does not occur within known or suspected species range
Pallid Bat *(Antrozous pallidus)*	**FS Sensitive**	**Rock crevices, tree hollows (particularly hardwoods), mines, caves and abandoned buildings below 6,000 feet elevation (Philpott 1997; USDA Forest Service 2001). Although the species has been found up to 10,000 feet elevation in the Sierra Nevada (Sherwin pers. com. 1998), it is considered scarce and localized at this elevation (Barbour and Davis 1969).**	**Project activities proposed in suitable habitat.**
Townsend's Big-eared Bat *(Corynorhinus townsendii)*	**FS Sensitive**	**Caves or mines and adjacent open, riparian and forest habitat to those features below 6,000 feet elevation (USDA Forest Service 2001).**	**Project activities proposed in suitable habitat.**
Western Red Bat *(Lasuirus blossevillii)*	FS Sensitive	Riparian and deciduous wooded habitats below 3,000 feet elevation (USDA Forest Service 2003; 2004b).	Project does not occur within known or suspected species range

CALIFORNIA SPOTTED OWL

The Eldorado National Forest occurs in the central portion of the range for the California spotted owl (CSO) and represents about 16% of the known population in the Sierra Nevada. There is a relatively uniform distribution of owl sites across the forest and adjoining the Tahoe National Forest to the north and Stanislaus National Forest to the south. On the Eldorado National Forest, California spotted owls are known to occur between 2,000 and 7,200 feet in elevation, with most nesting pairs found in the Sierran mixed conifer habitat type, the primary vegetation type in the project area.

In 2005, the U.S. Fish and Wildlife Service (USFWS) initiated a 12-month status review to determine if listing the species is warranted. The petition contended that several factors may have affected the status and distribution of the California spotted owl including: 1) Revisions to the 2001 SNFPA in the 2004 SNFPA; 2) Revisions to the California State Forest Practices Code; 3) possible changes to the draft meta-analysis of the population dynamics of the California spotted owl in the final, published meta-analysis (Franklin et. al. 2004); 4) impacts of recent fires and anticipated future fires in spotted owl habitat; and 5) further range expansion of the barred owl (Federal Register 2005). On May 23, 2006, the USFWS declined to list the species as threatened or endangered because the magnitude of threats to the California Spotted Owl did not warrant listing (Federal Register 2006).

In this determination, the USFWS evaluated full implementation of the scope and intensity of management actions across the Sierra Nevada as well as the implications of the proposed vegetation management and prescribed fire actions and related standards and guidelines contemplated in the 2004 SNFPA. They also evaluated other expected disturbances such as the effects of high severity wildfires and tree mortality and found that "the loss of habitat and subsequent population losses of spotted owls due to stand-replacing fire in unnaturally dense forest stands" was the primary threat to the owl and its habitat (Federal Register 2006). The USFWS acknowledged in their findings that "We recognize the difficult trade-offs involving short-term risk of fuel treatments versus long-term benefits of those treatments in reducing risks and improving habitat" and they concluded "that impacts from fires, fuels treatments, timber harvest, and other activities are not at a scale, magnitude, or intensity that warrants listing, and that the overall magnitude of threats to the California spotted owl does not rise to the level that requires the protection of the Act" (Federal Register 2006).

Suitable Habitat

Suitable habitat for the California spotted owl is generally described as mature forested habitats with moderate to large trees and moderate to dense canopy cover. Many spotted owl studies have described the stand conditions found to be used for nesting and roosting, which are generally areas with very large diameter trees, multiple canopy layers, greater than 70% canopy closure, and higher than

occurred after 2005 that would have altered conditions reflected in the eVeg data or visible in the aerial imagery.

TABLE 19 AMOUNT OF SUITABLE CALIFORNIA SPOTTED OWL HABITAT WITHIN BIG GRIZZLY PROJECT AREA

Category	Habitat	National Forest (Acres)	Non-National Forest (Acres)	Total
Suitable	Nesting	10,270	1,024	11,294
	Foraging	2,453	962	3,415
	Nesting/Foraging Total	12,722	1,987	14,709
	Low Canopy Foraging	403	120	522
Suitable Total		13,125	2,106	15,231
Potential	Nesting	1,805	112	1,918
	Foraging	1,321	345	1,666
Potential Total		3,126	457	3,583
Suitable+Potential Total		16,252	2,563	18,815
Non Habitat		3,000	635	3,635
Grand Total		19,252	3,198	22,450

Protected Activity Centers (PACs) and Home Range Core Areas (HRCAs)

The 2004 SNFPA provides that PACs (300 acres) and HRCAs (1,000 acres) are land allocations that should be re-evaluated during project planning (USDA Forest Service 2004, ROD pages 59-60). PACs and HRCAs in the vicinity of this project were evaluated to update their boundaries using the latest 2005 vegetation data and 2005 aerial imagery. The latest activity center, defined as the most recent best status location was defined by the District wildlife biologist using available survey data (C. Funari, pers comm.). PACs were delineated by photo interpretation of National Agricultural Imagery Program (NAIP) 2005 digital images where stands with visibly larger trees and higher canopy closure were manually digitized into the GIS. In most cases, visual delineation of stand boundaries was used instead of the mapped eVeg polygons and boundaries followed stand edges rather than fixed borders like roads, ridges or streams. The intent was to delineate the best available habitat that met the PAC delineation CWHR criterion outlined in the 2004 SNFPA. Approximately 4,731 acres of 16 PACs are located within the project area.

The activity centers were buffered by a 1.5 mile radius circle to define the outer boundary for the potential HRCA according to direction provided in the 2004 SNFPA. HRCAs were then defined as the nearest high quality blocks of habitat surrounding the PAC using photo interpretation and include the area of their respective PACs. Large areas of visibly lower quality habitat or non-habitat were excluded from the HRCA. Where smaller blocks of non-suitable habitat were included, the HRCA boundary was generally enlarged so that the final boundary included at least 1,000 acres of suitable habitat types. Attempts were made to define HRCAs as a contiguous block; however land ownership and vegetation patterns occasionally required a geographic separation across private land blocks. Where geographic separation occurred, only larger blocks were added to avoid including small isolated patches in the HRCA. Portions of twenty spotted owl HRCAs are within or overlap at least partially with the project area. Within the 22,450 acre project area, one or more HRCA covers approximately 11,719 acres (52% of the total project area or 61% of the NFS lands).

The Eldorado National Forest has adopted a more conservative HRCA mapping strategy than provided in the 2004 SNFPA where HRCAs are to be delineated to not include any acres of adjacent PACs. Where insufficient suitable habitat exists to map the 1,000 acre HRCA, excluding adjacent PACs, then all NFS lands within the 1.5 mile circle is designated as the HRCA according to this Forest policy. The rationale is that it is presumed that spotted owls actively defend the PAC area and given their territorial nature, it is unlikely that substantial habitat sharing occurs within the core territory area defined by the PAC. This presumes that PACs represent persistently

defending unique and independent territories. However, within the project area, three HRCAs (PLA0016, PLA0036 and PLA0098) cannot be reasonably mapped as contiguous or near contiguous while avoiding adjacent PACs. This is largely due to the density of owl territories and the checkerboard land ownership pattern. For these territories, the HRCAs were delineated both 1) as the nearest suitable habitat that includes some overlap with adjacent PACs; and 2) as the total NFS lands within the 1.5 mile circular area exclusive of adjacent PACs.

In addition to the mapped HRCAs, a 988 acre circular "core" area surrounding the activity center (Seamans and Gutierrez, 2007) was evaluated. The proportion of suitable habitat within the PACs, HRCAs and core area for each owl site is displayed in Table 20.

TABLE 20 AMOUNT OF SUITABLE HABITAT WITHIN CALIFORNIA SPOTTED OWL PACS AND HRCAS WITHIN THE BIG GRIZZLY EFFECTS AREA.

Nest Site	PAC/ HRCA	Total Acres	Nesting/ Foraging Habitat[1] (Acres)	Other Suitable Habitat[1] (Acres)	Non Suitable Habitat (Acres)
PLA0008	PAC	308	294	3	6
	HRCA	1024	804	198	22
	Core-FS	478	231	13	244
	Core-Pvt	501	410	32	59
	Core-Total	988	640	45	303
PLA0009	PAC	308	301	1	6
	HRCA	1,045	780	229	37
	Core-FS	606	488	39	79
	Core-Pvt	382	223	48	112
	Core-Total	988	711	86	191
PLA0010	PAC	307	303	4	0
	HRCA	1,019	941	59	20
	Core-FS	792	738	19	36
	Core-Pvt	196	167	19	10
	Core-Total	988	905	33	46
PLA0011	PAC	302	294	8	0
	HRCA	1,010	844	151	15
	Core-FS	606	435	136	35
	Core-Pvt	382	233	69	80
	Core-Total	988	668	205	115
PLA0012	PAC	305	293	8	0
	HRCA	1,059	976	44	38
	Core-FS	921	578	74	269
	Core-Pvt	67	9	47	11
	Core-Total	988	588	120	279
PLA0016	PAC	305	304	1	0
	HRCA	1,058	973	53	32
	HRCA-NP[2]	967	650	79	237
	Core-FS	510	456	33	20
	Core-Pvt	478	224	81	173
	Core-Total	988	680	114	193
PLA0036	PAC	307	303	0	3
	HRCA	1,002	958	26	18
	HRCA-NP[2]	3,108	2467	396	245
	Core-FS	826	734	52	40
	Core-Pvt	161	142	12	7
	Core-Total	988	876	64	47
PLA0038	PAC	309	177	87	3

Nest Site	PAC/ HRCA	Total Acres	Nesting/ Foraging Habitat[1] (Acres)	Other Suitable Habitat[1] (Acres)	Non Suitable Habitat (Acres)
	HRCA	1,003	939	52	12
	Core-FS	552	473	13	67
	Core-Pvt	435	403	5	27
	Core-Total	988	876	19	93
PLA0039	PAC	306	302	2	1
	HRCA	1,009	861	142	6
	Core-FS	988	776	175	36
	Core-Pvt	0	0	0	0
	Core-Total	988	776	175	36
PLA0040	PAC	302	300	3	0
	HRCA	1,013	994	13	7
	Core-FS	569	558	5	5
	Core-Pvt	419	261	114	44
	Core-Total	988	819	120	49
PLA0043	PAC	320	263	56	0
	HRCA	1,023	731	272	21
	Core-FS	962	564	308	90
	Core-Pvt	25	4	7	14
	Core-Total	988	568	315	105
PLA0049	PAC	303	255	44	3
	HRCA	1,037	877	128	31
	Core-FS	988	631	273	83
	Core-Pvt	0	0	0	0
	Core-Total	988	631	273	83
PLA0050	PAC	309	274	34	1
	HRCA	1,052	861	172	19
	Core-FS	687	484	119	85
	Core-Pvt	300	193	81	26
	Core-Total	988	677	200	111
PLA0066	PAC	303	291	12	1
	HRCA	1,000	859	124	19
	Core-FS	823	547	210	66
	Core-Pvt	164	129	20	15
	Core-Total	988	676	230	82
PLA0067	PAC	308	299	7	2
	HRCA	1,056	954	75	27
	Core-FS	988	732	75	182
	Core-Pvt	0	0	0	0
	Core-Total	988	732	75	182
PLA0080	PAC	300	257	41	2
	HRCA	1,005	940	62	3
	Core-FS	909	769	122	17
	Core-Pvt	79	71	0	8
	Core-Total	988	841	122	25
PLA0098	PAC	304	285	10	9
	HRCA	1,032	982	24	26
	HRCA-NP[2]	1,057	780	88	189
	Core-FS	521	467	36	17
	Core-Pvt	467	408	43	16
	Core-Total	988	875	79	33

Nest Site	PAC/ HRCA	Total Acres	Nesting/ Foraging Habitat[1] (Acres)	Other Suitable Habitat[1] (Acres)	Non Suitable Habitat (Acres)
PLA0109	PAC	301	271	24	6
	HRCA	1,031	841	146	44
	Core-FS	717	490	154	72
	Core-Pvt	271	195	76	0
	Core-Total				

PAC	Most Recent status	Best Status	Occupancy Status (Number of Years - 1986 to 2008)				
			Repro	Non-Repro[1]	Pair	Single	Unknown[2]
PLA0012	2007 Single	2002 Family	7	9	4	1	2
PLA0016	2007 Single	1995 Family	3	3	5	10	2
PLA0036	2005 Single	1997 Family	5	2	4	5	12
PLA0038	2008 Pair	2007 Family	7*	5	3	4	4
PLA0039	2008 Family	2008 Family	3	4	5	8	3
PLA0040	2008 Pair	2007 Family	7*	9	2	3	2
PLA0043	2007 Single	1986 Family	1	1	3	11	7
PLA0049	2006 Single	1993 Family	4	3	4	6	6
PLA0050	2008 Family	2008 Family	9*	6	5	3	0
PLA0066	2008 Single	1993 Pair	0	0	4	14	5
PLA0067	2007 Pair	1997 Family	1	5	4	5	8
PLA0080	2008 Family	2008 Family	7*	12	0	0	4
PLA0098	2007 Pair	2004 Family	6*	5	5	2	5
PLA0109	2004 Pair	2002 Family	1	1	3	6	12
PLA0113	2008 Pair	2007 Family	6*	7	3	3	4
PLA0115	2007 Single	1992 Family	1	2	4	4	12

[1] Non-Repro are records where pairs are determined to be non-reproductive or failed reproduction
[2] Unknown may be no survey data or no detections.
* Sites reproductive three or more times in the period 1998-2008

Other Population Demographics

Recent research has found that population growth rate is highly correlated with weather variability, as well as being sensitive to suitable habitat quality where dense high quality habitat may better shelter owls from the adverse effects of weather (Seamans 2005; North et al. 2000; Lee and Irwin 2005). Lee and Irwin (2005) suggest that owls tend to attempt nesting more frequently in higher quality habitat. The 2008 Annual Report for the Eldorado Demographic Study Area, which includes the project area, indicated that the population rate of change from 1992 to 2007 was stable (Gutierrez et al. 2009).

One researcher has identified a concern with the percentage of California spotted owl territories occupied on the Eldorado Demographic Study Area over time (Tempel 2008). Using a baseline of the cumulative total of historically occupied territories, he displays a graph (his Figure 4) covering the period 1990-2008. However, in examining his data (summary spreadsheet in project file), prior to 1997, the status of several territories was unknown and the percentage

of occupied territories was calculated on a smaller baseline, potentially inflating the percentage. For example, in 1990, there were 28 occupied territories, 4 unoccupied territories and 15 unknown territories for a total of 47 territories. Tempel's graph shows the percentage occupied as 87.5% (28/32). However, in both 2000 and 2002, there were similarly 28 occupied territories, 20 unoccupied territories and no unknown territories but in this case it was shown as 58.3% (28/48), a 29% decline compared to 1990. Since 1997, when the surveyed number of territories stabilizes around 48 territories (47 in three years and 49 in one year), the number of occupied territories has decreased from 37 of 47 in 1997 to 20 of 48 in 2008. The relationship of occupied territories to population trends remains unclear as the overall study period rate of population change (lambda) remains stable across this time period (Gutierrez et al. 2009) despite this decrease in occupied territories. There is a concern that because the CSO has a relatively long lifespan, the rate of population change may exhibit a lag time effect (Gutierrez et al. 2008b).

Thresholds to evaluate effects to Home Range Core Areas (HRCAs)

There are no defined thresholds for the specific amount and types of suitable habitats that should be provided in HRCAs other than the overall amount and direction to include the best quality habitat reasonably available. Neither the CASPO Technical Report (Verner et al. 1992) nor the SNFPA defines habitat thresholds or sets management requirements based upon the amount of suitable habitat within HRCAs. The current published scientific literature does not identify cause and effect thresholds for habitat changes in a manner that allows easy inference of potential effects. It has been suggested that treatment of more than 20% of an HRCA is a threshold for adverse effects. However, there is no scientific study to suggest such a threshold. The SNFPA 2004 assumed that application of a strategically placed pattern of treatments would affect approximately 20 percent of the landscape and thus 80 percent of the landscape would likely be untreated in the 20 year estimated timeframe to implement the SNFPA strategy (USDA Forest Service, 2004). The SNFPA (2004) did not determine that adverse effects would occur if more than 20% of an HRCA was treated. The SNFPA 2004 analysis recognized that strategically placed area treatments (SPLATs) would not be applied in a rigid geometric pattern and that logistical realities and direction to avoid sensitive areas would result in a variable treatment pattern across the landscape. The SNFPA (2004) determined that habitat alteration thinning treatments of 20 percent of the landscape were generally unlikely to have a significant adverse affect on CSO, although it also recognized that local factors need to be considered during individual project analysis.

NORTHERN GOSHAWK

Northern goshawks occur in forested habitats throughout the northern hemisphere. It is estimated that there are around 600 known goshawk territories on National Forest system lands in the Sierra Nevada, with about 70 territories occurring on the Eldorado National Forest. Territories appear to be well distributed across the Sierra, however occupancy of many territories is unknown and population trend in the Sierras is unknown due to a lack of wide-spread demography studies for this species. On the Eldorado National Forest known goshawk sites appear to be fairly well distributed across the forest, between 4,000 and 7,000 feet in elevation.

Suitable Habitat

Suitable habitat for the Northern goshawk consists of mature forested habitats with large trees, dense canopy cover with at least two canopy layers, and abundant snags and down logs (USDA Forest Service 2001 and 2004). High and Moderate Quality habitat are defined by the California Wildlife Habitat Relationships Models (CWHR). High capability habitat is described as CWHR Types 4M, 4D, 5M, 5D in certain habitat types (i.e. Sierra Mixed Conifer). Moderate Capability habitat includes 5S and 5P and 4M, 4D, 5M, 5D in lesser utilized habitat types. In general, on the Eldorado National Forest foraging habitat is defined as canopy cover greater than 40% and trees greater than 12 inches dbh (CWHR 4M, 4D, 5M, 5D), and nesting habitat is defined as canopy cover greater than 60% and trees greater than 24 inches dbh (CWHR 5M and 5D). Table 22 displays the amount of suitable Northern goshawk habitat available within the cumulative effects analysis area and within the project area.

TABLE 22 AMOUNT OF SUITABLE NORTHERN GOSHAWK HABITAT WITHIN THE BIG GRIZZLY CUMULATIVE EFFECTS ANALYSIS AREA AND PROJECT AREA.

Cumulative Effects Analysis Area	Total Habitat acres within Cumulative Effects Analysis Area		Non-National Forest Habitat Acres within Cumulative Effects Analysis Area	Habitat Acres within Project Area
1.5 mile radius of proposed units **48,680** acres	High	25,240	6,914	11,995
	Moderate	6,252	1,062	2,340
	Total Suitable	**31,493**	**7,976**	**14,335**

Literature suggests that besides the basic CWHR definition of suitable nesting and foraging habitat for the northern goshawk, diversity in stand structures afforded by variations in tree structures, typical of old growth trees, is the primary predictor of goshawk and other raptor nest sites (Lohmus 2005). Lohmus 2005 also suggests that the removal of trees through timber harvesting does not impact raptor nest site selection when old growth type tree structures are retained. Although goshawks have been shown to prefer nesting in mature forest habitats, it has recently been shown that the more similar goshawk breeding areas are to suitable habitat definitions, the lower the reproductive output (Beier et al 2008). Recent literature demonstrates that goshawk productivity is positively correlated with prey availability and abundance, but which prey species and the strength of correlation depends upon vegetation type. Ponderosa pine forests show a much stronger correlation than mixed conifer forests (Salafsky et al 2007).

Protected Activity Centers

Northern goshawk protected activity centers (PAC) have been delineated around territorial goshawk activity centers. Habitat patches surrounding nest locations are known to range from 25 to 250 acres in size. The SNFPA required 200 acre protected activity centers (PAC) have been delineated around breeding sites. Table 23 shows the number of acres of northern goshawk pack within the cumulative effects analysis area.

TABLE 23 ACRES[1] OF SUITABLE HABITAT WITHIN NORTHERN GOSHAWK PACS WITHIN THE BIG GRIZZLY PROJECT AREA

Nest Site	Habitat Acres within C.E. Analysis Area		
	Highly Suitable	Moderate Suitable	Total Suitable
G04_01	178		178
G04_02	150		150
G04_05	257		257
G04_06	193		193
G04_07	165		165
G05_04	146	53	198
G06_01	29	134	163
G10_01	122	76	197
G10_02	210	80	291
G10_03	199	1	200
G10_04	227	53	280
G10_05	201	10	211
G10_06	140	71	212
G10_07	184	90	274
G10_08	120		120
G10_09	92	156	247

Nest Site	Habitat Acres within C.E. Analysis Area		
	Highly Suitable	Moderate Suitable	Total Suitable
G10_10	245		245
G11_07	125	64	189

Status of Protected Activity Centers

Most recent surveys were conducted in 2007 and 2008 for PACs within the project area and within a half mile of proposed units. Northern goshawks tend to be secretive and subsequently more difficult to find, thus there is limited potential that there could be unknown nest sites within the project area that were not detected by past protocol surveys. In addition, goshawks move nest sites frequently and generally have multiple nests sites that they use in an alternating fashion within their territory. Table 24 displays the status of Northern Goshawk Protected Activity Centers identified in the Big Grizzly cumulative effects analysis area.

TABLE 24 STATUS OF NORTHERN GOSHAWK TERRITORIES WITHIN THE BIG GRIZZLY CUMULATIVE EFFECTS ANALYSIS AREA

PAC	Best Status/Year	Last Status/Year	Last Surveyed
G04_01	1991/Family	2002/Single	2008
G04_02	1998/Family	1998/Family	1998
G04_05	2007/Family	2007/Family	2008
G04_06	2002/Family	2002/Family	2002
G04_07	2008/Family	2008/Family	2008
G05_04	1998/Family	1998/Family	1998
G06_01	1990/Family	1997/Single	2008
G10_01	2003/Family	2003/Family	2008
G10_02	2008/Family	2008/Family	2008
G10_03	1994/PAIR	2007/Single	2008
G10_04	2008/Family	2008/Family	2008
G10_05	2008/Family	2008/Family	2008
G10_06	2007/Family	2007/Family	2007
G10_07	2008/Family	2008/Family	2008
G10_09	2008/Family	2008/Family	2008
G10_10	2008/Pair	2008/Pair	2008

Other Population Demographics

Research has shown that spring weather conditions have a greater impact upon goshawk reproduction than timber harvests (Moser and Garton 2004), however; some human disturbances to goshawk nests have been a suspected cause of nest abandonment. Critical times for human disturbance are through the nesting and post fledging period (February 15 through September 15). Because northern goshawks initiate breeding when the ground is still covered with snow and roads and trails are not in use, nests are sometimes directly located along roads and trails that provide flight access.

The Forest Service, Region 5, has generally assumed that activities occurring farther than 0.25 miles from a goshawk nest site have little potential to affect goshawk nesting (USDA Forest Service, 2004). Little information is available on the distance at which sound or visual disturbances are likely to disrupt behavior of nesting goshawks but, as with other raptors, the likelihood of flushing from the nest or nest abandonment is expected to increase as the distance from the disturbance decreases (USDI Fish and Wildlife Service 2006).

PACIFIC FISHER

The FWS was petitioned to list the Pacific fisher under the Endangered Species Act in 1990 and 1994. In both cases the FWS determined that there was insufficient information to warrant a status review. A third petition was submitted to the FWS on November 27, 2000. On April 8, 2004, in response to this petition, the Service published its 12-month finding in the Federal Register (69FR18769). The Service determined that listing of the fisher was "warranted but precluded"; therefore appropriate status for this species is as a candidate for listing under the Act. Fisher populations are presently at low numbers, or absent throughout most of their historic range in Montana, Idaho, Washington, Oregon, and California" (Heinmeyer and Jones In USDA 2001). Small populations of fisher occur in northwestern California and the southern Sierra in very low numbers (USDA Forest Service, 2001).

Suitable Habitat

Habitat characteristics for Pacific fisher are believed to be mature timber stands with moderate to fairly dense canopy cover, large trees, and abundant snags and down logs (USDA Forest Service 2001 and 2004). Mature hardwoods are also thought to be important habitat components used by fisher, and the presence of large conifers and hardwoods is a highly significant predictor of fisher occurrence (USDA Forest Service 2005b). Preferred habitat for fisher is generally found between 3,000 and 8,000 feet elevation in large, relatively unfragmented blocks of older forest, characterized by a 60% to 100% canopy closure, multistoried structure, and a high number of large snags and down logs. It is clear from available literature that canopy cover over 60% is important, as fisher preferentially select home ranges to include high proportions of dense forested habitat (Zielinski et al. in press-b, Mazzoni 2002 In USDA Forest Service 2004); however, home ranges also included significant amounts (32-67%) of habitat with less than 50% canopy cover scattered throughout larger blocks of high canopy/density habitat. Suitable habitat in this analysis is defined as forested types with CWHR 4M, 4D, 5M, 5D, 6. Preferred habitat or denning habitat is defined as CWHR class 5D with canopy cover greater than 80%.

Self and Kerns (2003 In USDA Forest Service 2001) found that fisher used stands having 25-40% canopy closure if there were some areas of high density canopy cover to provide for rest sites. Habitat suitable for resting and denning sites may be more limiting. Fisher apparently use greater percentages of middle to early seral stage habitats (like plantations) for foraging during summer months. Fisher generally avoids open habitats with no overstory or shrub cover (Buskirk and Powell 1994 In USDA Forest Service 2001). Fisher also prefers areas with road densities less than one-half mile per square mile (USDA Forest Service 2001).

Fisher primarily has a diet composed of reptiles, amphibians, insects, fungi, small mammals, deer, and birds in the Sierra. It is thought that fisher feed opportunistically in the Sierra Nevada, and that no one single food-type can be associated with fisher presence or abundance (Fisher and Marten in California Conference 2006).

The suitability of the project area for fisher is limited by the level of disturbance present on adjacent and included private lands which are patchworked throughout the area. The habitat within the Big Grizzly project area is concentrated mainly in drainages within Sierra Mixed Conifer habitat. The Rubicon Canyon to the south provides a suitable

corridor for movement. Table 25 displays suitable fisher habitat within the cumulative effects analysis area and the project area.

TABLE 25 AMOUNT OF SUITABLE PACIFIC FISHER HABITAT WITHIN THE BIG GRIZZLY CUMULATIVE EFFECTS ANALYSIS AREA AND PROJECT AREA

Cumulative Effects Analysis Area	Habitat acres within Cumulative Effects Analysis Area		Non-National Forest Habitat Acres within Cumulative Effects Analysis Area	Habitat Acres within Project Area
3 mile radius of proposed units **89,373** acres	Suitable	53,187	19,689	14,071
	Denning/Resting	2,026	541	264
	Total Suitable	**57,255**	**21,125**	**14,335**

Status of Pacific Fisher in the Project Area

There have been no sightings of fisher within the project area although specific surveys have not been conducted. Sightings have been reported adjacent to the project area near Stumpy Meadows Reservoir and in the Rubicon River Drainage (USDA Forest Service 2007). Several track plate/camera surveys have occurred on the Eldorado National Forest in compliance with 1992/1993 and 1997 Regional survey protocols with no detections. It has been conjectured that based upon the lack of recent sightings and results of limited systematic surveys, it is possible that fisher have been extirpated from the Sierra Nevada north of Yosemite National Park and south of Lassen National Park (USDA Forest Service 2001). However, since recent surveys have not been conducted for fisher in the project area, and based on the couple sighting records mentioned above, it is assumed that there could be fisher in the project area.

The current management strategy for Pacific Fisher relies on old forest emphasis areas to address habitat for fisher and other old forest species as well as utilizing owls and goshawks PACs for conservation of fisher/old forest species habitat within the forest. The breakdown of late-seral habitat impacts within the analysis area into suitable, high and denning habitat should be adequate for the determination of impacts to fisher from the proposed projects as this method is utilized for all other species without specified management areas located within the analysis area.

Other Population Demographics

The loss and fragmentation of suitable habitat by roads and development is thought to have played a significant role in both the loss of fishers from the central Sierra Nevada and its failure to recolonize this area (USFWS 2004). Campbell (2004, in USFWS 2004) found that sample units within the central and southern Sierra Nevada region occupied by fishers were negatively associated with road density. This relationship was significant at multiple spatial scales (from 494 to 7,413 acres).

AMERICAN MARTEN

American Marten are typically found in the elevation range from 5,500 feet to 10,000 feet. They are most often found above 7,200 feet in elevation in the red fir zone, which forms the core of marten occurrence in the Sierra Nevada (USDA Forest Service 2001). On the Eldorado National Forest, marten have not been detected below 5,000 feet in elevation and predominantly occur above 6,000 feet in elevation (USDA Forest Service 2005b).

Suitable Habitat

Martens prefer structurally diverse coniferous forest habitat with large diameter trees and snags, large down logs, moderate-to-high canopy closure, and an interspersion of riparian areas and meadows (USDA Forest Service 2001). The 4M, 4D, 5M, 5D, and 6 CWHR habitat types above 5,000 ft in elevation are moderately to highly important for marten and are defined here as suitable habitat. Preferred denning/resting habitat is composed of greater than 9 per acre greater than 24" dbh, greater than 70% canopy cover, and an average of 5 large snags greater than 24" dbh per acre; CWHR size class 5D and 6 with vegetation density greater than 70% above 5,000 ft in elevation would be classified as preferred denning/resting habitat. Foraging habitat consists of trees greater than 6 trees per acre greater than 24"

dbh, greater than 40% canopy cover, and an average of 2.5 large snags greater than 24" dbh per acre.

Small open areas and plantations are used by marten as foraging habitat, but these openings are of optimum value when they occupy a small percent of the landscape adjacent to mature forest habitat. Marten prefer forested landscapes where open, non-forested patches comprise less than 25% of the landscape and relatively lower amounts of edge (Hargis et al. 1999). Table 26 displays suitable American marten habitat within the cumulative effects area and the project area.

TABLE 26 AMOUNT OF SUITABLE AMERICAN MARTEN HABITAT WITHIN THE BIG GRIZZLY CUMULATIVE EFFECTS ANALYSIS AREA AND PROJECT AREA

Cumulative Effects Analysis Area	Habitat acres within Cumulative Effects Analysis Area		Non-National Forest Habitat Acres within Cumulative Effects Analysis Area	Habitat Acres within Project Area
3 mile radius of proposed units **89,373** acres	Suitable	13,701	4,975	3,907
	Denning/Resting	900	133	198
	Total Suitable	**14,601**	**5,108**	**4,105**

Status of American Marten in the Project Area

The project occurs between 4,000-5,600 feet in elevation, which is on the lower elevation range of marten. Marten have not been documented in the project area, although there is potential for marten to occur within and adjacent to the project area at higher elevations. Several track plate/camera surveys have occurred on the Eldorado National Forest in compliance with 1992/1993 Regional survey protocols with detections of marten in other areas of the forest. The nearest detection of marten is over 6 air miles to the east of the project area. However, since recent surveys have not been conducted within the project area, it is assumed that marten may be present within suitable habitat in the project area.

PALLID BAT

Habitat for the pallid bat consists of brush, hardwood and coniferous forests and dry habitats with rocky areas for roosting below 6,000 feet elevation (Philpott 1997 In USDA Forest Service 2005b, USDA Forest Service 2001). Although the species has been found up to 10,000 feet elevation in the Sierra Nevada, it is considered scarce and localized at this elevation.

Suitable Habitat

Pallid bats prefer day roosts where they can conceal themselves from view, such as rock crevices, tree hollows, mines, caves, and a variety of human-made structures. Tree roosting has been documented in large conifer snags, inside basal hollows of redwoods and sequoias, and bole cavities in oaks (Sherwin 1998 In USDA Forest Service 2005b). There is a strong association with roosting in black oak cavities. Little is known about the winter habits of this species although it is thought to winter near the summer roost sites. Pallid bats forage near the ground level and on the ground.

Because of the variety of habitat in which pallid bats are found, potential habitat as defined in this analysis consists of hardwood, riparian and coniferous forest habitats up to 10,000 feet. Preferred habitat is considered montane hardwood, montane hardwood conifer and montane riparian habitat due to their preference for roosting and foraging in these areas. Table 27 displays the amount of suitable pallid bat habitat available within the cumulative effects analysis area and within the project area.

TABLE 27 AMOUNT OF SUITABLE PALLID BAT HABITAT WITHIN THE BIG GRIZZLY CUMULATIVE EFFECTS ANALYSIS AREA AND PROJECT AREA.

Cumulative Effects Analysis Area	Habitat acres within Cumulative Effects Analysis Area		Non-National Forest Habitat Acres within Cumulative Effects Analysis Area	Habitat Acres within Project Area
1 mile radius of proposed units **36,631** acres	Potential Habitat	**35,705**	**10,464**	**21,951**
	Preferred Habitat	8,886	2,367	5,669

Status of Pallid Bat in the Big Grizzly Project Area

No surveys for the pallid bat have been conducted in the area, and the distribution of this species across the Forest is unknown. In the absence of surveys, this analysis assumes pallid bat occurs within the project area.

Other Population Demographics

Maternal roosts are typically colonies (typically between 20 to several hundred individuals). Breeding occurs between May and July, with young weaned in mid-late August (Sherwin 1998 In USDA Forest Service 2005b) and maternity colonies breaking up by mid-October (Barbour and Davis 1969 In USDA Forest Service 2005b).

TOWNSEND'S BIG EARED BAT

The Townsend's big-eared bat occurs throughout the west, and is distributed from the southern portion of British Columbia south along the Pacific Coast to central Mexico and east into the Great Plains (Sherwin 1998 In USDA Forest Service 2005b). In California, the species is typically found in low desert to mid-elevation montane habitats, although sightings have been reported up to 10,800 feet. Populations have incurred serious declines over the past 40 years in parts of California (Brown 1996 In USDA Forest Service 2005b).

Suitable Habitat

Habitat associations include desert, native prairies, coniferous forests, mid-elevation mixed conifer, mixed hardwood-conifer forests, riparian communities, active agricultural areas and coastal habitat types (Kunz and Martin 1982, Brown 1996, Sherwin 1998 In USDA Forest Service 2005b). Distribution of this species is strongly correlated with the availability of caves and cave-like roosting habitat (Sherwin 1998 In USDA Forest Service 2005b).

Foraging usually begins well after dark. Foraging associations include edge habitats along streams and areas adjacent to and within a variety of wooded habitats (Sherwin 1998 In USDA Forest Service 2005b). In California, the species is shown to forage preferentially in association with native vegetation (Brown 1996 In USDA Forest Service 2005b).

The Townsend's bat is a moth specialist, with over 90% of its diet composed of lepidopterans (Sherwin 1998 In USDA Forest Service 2005b). Foraging habitat for Townsend's big-eared bat is available within the analysis area along stream courses. There are several historic mines within the project area that may provide roosting habitat for this species.

Because of the variety of habitat in which Townsend big-eared are found, potential habitat as defined in this analysis consists of hardwood, riparian and coniferous forest habitats up to 10,000 feet. Preferred habitat is considered montane hardwood, montane hardwood conifer and montane riparian habitat due to their preference for roosting and foraging in these areas.

TABLE 28 AMOUNT OF SUITABLE TOWNSED BIG EARED BAT HABITAT WITHIN THE BIG GRIZZLY CUMULATIVE EFFECTS ANALYSIS AREA AND PROJECT AREA.

Cumulative Effects Analysis Area	Habitat acres within Cumulative Effects Analysis Area		Non-National Forest Habitat Acres within Cumulative Effects Analysis Area	Habitat Acres within Project Area
1 mile radius of proposed units **36,631** acres	Potential Habitat	**35,705**	**10,464**	**21,951**
	Preferred Habitat	8,886	2,367	5,669

Status of the Townsend Big-Eared bat in the Big Grizzly Project Area

Comprehensive surveys for Townsend's big-eared bat have not been conducted on the Eldorado National Forest. In the absence of surveys, presence is assumed since suitable habitat is available.

TERRESTRIAL WILDLIFE CUMULATIVE EFFECTS ANALYSIS METHOD

All of the terrestrial sensitive species addressed in this BE depend upon late-seral habitat conditions (CWHR 4M, 4D, 5M, 5D, and 6). On National Forest lands, however recent past activities (as well as present activities) were designed to maintain or promote the growth of old forest habitat. Canopy closure in the forest stands have been reduced in treated stands (for example a 5D stand may have been reduced to 5M), however most of the treatment units maintained a minimum CWHR type 4M, which is within the range of habitats suitable for sensitive wildlife species that depend on late-seral habitats. Vegetation management activities that have occurred on private lands within the analysis area likely removed habitat.

The area analyzed for each species is different to accommodate the variety of home range or buffer sizes of each species. The Analysis area is the home range of each species in addition to the project boundary. The analysis area radius is calculated from the home range utilizing the area of a circle mathematical formula: Radius = square root (home range ÷ π). For species with unknown occupancy, this radius is doubled. Literature on home range gives a wide range of sizes and factors affecting the actual size of the home range.

For Pacific Fisher, comparison of literature and radio telemetry studies gives an average female home range of 5.78 square miles; however, home range is chiefly determined by habitat quality (USDA Forest Service 1991). For the California Spotted Owl, the Sierra Nevada Framework guidelines delineate home range core areas based upon a maximum radial distance of 1.5 miles from the nest site (USDA Forest Service 2001). For the Northern Goshawk: nest stands are 25 to 250 acres, post-fledging areas average 420 acres, and for females foraging areas are about 5,000 acres or 7.81 square miles (USDA Forest Service 2005b).

Literature gives a range of 0.35 to 5 square miles for the American Martin (USDA FS 2006). Therefore, an average of 3 square miles will be utilized. For the Pallid Bat the home range is between 0.5-2.5 miles, which gives a radius of 1.5 miles (CDFG 2005). For the Townsend's big-eared bat the home range for most individuals is given as "not more than a few kilometers" which equates to a home range of 1.86 miles, giving a radius of 0.93 miles.

Reported home range sizes for the Black-backed woodpecker included 178 to 810 ac with a median of 306 ac in Oregon (Goggans et al. 1988 in NatureServe 2007); 374 ac in Quebec (Tremblay 2009); 178 ac (Dixon and Saab 2000); and 151 ac in Idaho (Vermont, Lisi 1988 in NatureServe 2007). Using 306 acres or 0.48 square miles the cumulative effects analysis area is 0.4 miles.

The largest cumulative effects analysis area is that of the Pacific fisher which is radius 3 miles beyond the project units is. This area is used as the cumulative effects analysis area for general effects because it encompasses all late seral species home ranges, and in doing so their cumulative effects analysis areas.

EFFECTS

ALTERNATIVE 2 (NO ACTION)

Since no new management activities would occur with Alternative 2, there would be no project-related disturbance to the sensitive wildlife species that potentially occupy habitat within the project area. Habitat conditions would remain the same in the short-term. In the long-term, this alternative may result in the continued increase in late-seral conditions in some areas as stands mature resulting in increased habitat for late seral species and their prey. However, these increases are expected to take longer to occur than with the Proposed Action.

It is expected that the continual establishment of white fir and Douglas-fir would continue to outcompete hardwoods in proposed treatment areas. A decrease in hardwoods could reduce habitat for species such as the fisher and pallid bat. Habitat conditions for species that require movement through the stand for foraging, such as bats and goshawks may be reduced as stand densities increase. Some small mammal and bird prey that require herbaceous and shrub vegetation would similarly have decreased habitat quality as canopy shade at the ground increases.

Alternatively, this alternative could result in a decrease in late seral conditions in some areas, as the large diameter, overstory trees die from competition in overstocked stands. This could be exacerbated if

drought conditions or insect infestations occur. Dense stands proposed for thinning would continue to increase in density making them more susceptible to tree mortality from wildfire and insects, particularly following periodic droughts. This could result in mortality in many of the larger and older trees which are important habitat elements.

There may be some short-term foraging benefit from untreated disease pockets in stand improvement units, as the abundance of snags and down logs could provide habitat for small mammal prey species. However, it is likely that these areas would continue to degrade in foraging quality for species such as goshawk and California spotted owl as the mortality patches get larger. It is unlikely that these areas would provide nesting quality habitat in the future. The continued spread of the Annosus fungus through the white fir dominated stands would continue to provide snags for snag dependent species such as the variety of woodpeckers, sapsuckers and migratory birds such as wrens that occur throughout the forest, which are prey species for sensitive wildlife such as goshawks. The reduced canopy cover in the stand improvement units may increase shrub and herbaceous species regeneration in areas in which canopy cover is completely eliminated or reduced. The increase in shrub and herbaceous species may result in increased forage for some sensitive species prey and other wildlife such as deer and quail.

Woodrats, an important prey species for the California spotted owl, are both harmed and benefited by high severity wildfire depending upon the size and location of burned patches and post-fire management and vegetation development. Woodrats nest in middens of sticks and branches that are highly flammable and readily burn in even low severity wildfires. However, post-fire shrubs may provide high quality habitat if some residual trees survive or as trees grow. One study suggests that these post-burned environments can enhance spotted owl foraging by providing high woodrat and other prey species densities and in the studied cases, found that spotted owls preferentially foraged in burned patches (Bond et al. 2009). This benefit of potentially increasing prey densities for spotted owls is tempered by the loss of high quality nesting and roosting habitat caused by high severity wildfire. While spotted owls have been found to occur in some burned environments for several years following wildfires (Bond et al. 2009), they have not been documented to maintain productive territories except where sufficiently large patches of living trees that provide nesting and roosting habitat conditions remains, primarily in mixed severity wildfires and along the edges of high severity wildfires (Keane 2010). Even in the Bond et al. 2009 study, the studied owls were located along the edges of the fire and were in proximity to unburned habitat that provided for nesting and roosting.

Under the No Action Alternative, the mastication units would most likely remain early seral dense conifer habitat for a longer time period due to high nutrient and water competition. With no mastication or herbicide, shrubs and younger conifer seedlings/saplings would not be removed and would provide cover longer for species such as fisher, small rodents and shrub nesting bird species which require high canopy cover in their habitat. Avian and mammalian prey species which depend on early seral stands with dense shrub and young trees should remain abundant within these stands.

Cumulative Effects for Alternative 2

Selection of this alternative would result in minimal contribution to cumulative effects as no management activities would occur.

Suitable sensitive species habitat in and adjacent to the project area could be threatened since the risk of catastrophic wildfire would not be reduced. Without activities to reduce fuels, areas with heavy and near continuous fuels would occur on most NFS lands in the project area. This would result in a continued high potential for a wildfire to burn with moderate and high severity in the area which could result in substantial mortality in existing mature trees and substantial loss of canopy closure which could reduce the amount of suitable habitat. To the extent that sufficient habitat is degraded by wildfire it could affect the number and distribution of late seral species habitat in the project area. Implementation of other fuels reduction activities in adjacent areas or a re-evaluation of fuels reduction in the project area in the future could serve to reduce this risk to some extent.

Alternative 2 would not immediately add to the declining trend in sensitive species habitat throughout the 3 mile cumulative effects analysis area. Due to the lack of fire resiliency across the current landscape described in Ebert (2009), Alternative 2 would not protect this late seral habitat

from a large scale stand replacing fire that may occur in the future.

ALTERNATIVE 1 (PROPOSED ACTION)

GENERAL EFFECTS

In most of these areas, woodrats, deer mice, flying squirrels and Douglas squirrels are the primary prey species. Prey species responses to a reduced understory post treatment should vary. Some prey species would mostly likely decrease within the mastication, thinning, and plantation units, as well as tractor piling units for the first 3-5 years, as many species are positively related to shrub cover and woody debris. Other prey species may increase due to the more open understory and canopy cover. In herbicide units, these understory changes would be prolonged to 5-10 years following treatments.

The expected decrease in white fir and incense cedar and an increase in pine and hardwoods over the project area would decrease habitat for wildlife species that utilize structure of fir and incense cedar for travel (flying squirrels) or foraging (California spotted owls). However, the possible increase in oaks should increase foraging for bears, deer, turkey and other wildlife species that forage on acorns and increase habitat for species that utilize large oaks for nesting, resting and denning.

An important prey species, the northern flying squirrel, requires large trees, large snags, coarse woody debris, perennial water, and lichen/truffles as main habitat components. The project is designed to improve conditions within treated stands such that the likelihood of survival is increased for individual medium and large trees, thus better ensuring their retention into older age classes and likelihood t provide high quality habitat for the flying squirrel i the long-term. In the short-term there would b fewer decaying snags and potential trees available fo cavity makers, however, large snags should remai above forest standards and guidelines in the shor and long-term. As coarse woody debris may b affected by this project, there may be some sho term disturbance of truffles. Since arboreal lic are found primarily in larger older living t they would largely be unaffected by this project. Treatments are designed to reduce the risk of stand loss from high severity wildfire, thus there may be some long-term benefit to arboreal lichens to the extent that this outcome occurs.

The removal of overtopping and encroaching conifers for black oak enhancement would increase the distance between trees for flying squirrel movement; however, the openings would be less than the typical glide distance as the average spacing between trees is expected to be approximately 10-50 feet.

Tractor piling and burning reduces down woody debris thereby contributing to a simplified understory stand structure. Some species, such as woodrats, may be negatively impacted by this decrease, and may therefore decrease in abundance. However, understory thinning, follow-up tractor piling and prescribed burning may increase the presence and abundance of that small and large mammals (such as deer mice, ground squirrels and deer) the long-term, if not the short-term. This increase is expected to occur where the understory vegetation is nearly absent due to heavy litter layers.

Treatment units thinned from below would have shrubs retained unless they pose a direct fuel ladder into the crowns of adjacent trees continuing to provide some habitat for woodrats and other small mammals and birds in the short term. This would increase the likelihood that treated units would provide for usable foraging habitat sooner than the 3 to 5 years it is expected to take for brush to re-grow within units where it is removed. However, follow-up tractor piling and burning would result in a further short-term decrease in shrubs.

Where large areas of brush are removed, understory cover or herbaceous foraging areas within plantations and thinning stands may not provide habitat temporarily for some prey species such as dusky-footed within and would

for landings for project slash and to process logs. These areas could exceed the typical glide distance of flying squirrel; however, most landings are within areas previously used as landings thus the effects on movement are likely already accommodated by existing individuals. A few new landings would be created to process the trees from this project; however, the distribution of these is not expected to create substantial barriers to movement by individuals in the project area.

In stand improvement units, wildlife that inhabit gap areas would be impacted by the conversion of mid-seral to early-seral habitat. Gaps should increase habitat heterogeneity across the landscape and within stands, and should allow for slightly more habitat for those animals that utilize more than one seral stage such as deer and turkeys. The gaps generated in the improvement units could exceed a typical glide distance of a flying squirrel. However, these gaps are dispersed within generally open white fir stands as a result of the existing Annosus root disease, where some impact to movement already could exist. The extent of these treatments is limited such that it is not expected that they would create substantial barriers to movement across the landscape or inhibit interactions between individuals.

Plantations are currently habitat for woodrats which are the prime prey species for many sensitive species in this area, particularly spotted owls. Their abundance is generally correlated with vegetation density and is most abundant in sapling and early-pole timber stands with a brushy understory component (Carey et al. 1992, 1999). This project is anticipated to reduce short-term habitat for the dusky-footed woodrat in treated areas, but may potentially increase habitat suitability once shrub cover recovers and oak mast increases as a result of oak enhancement. Large areas of untreated habitat within the project area should continue to provide suitable habitat for woodrats during the period of shrub and understory re-growth within treated units.

Mastication as proposed in these plantations, targets younger conifers and brush. In more dense stands, masticated material can leave a dense bed of chipped material that impedes the growth of brush and herbaceous species for a period of time. The drastic reduction in understory vegetation could decrease prey species in these areas. However, while herbicide application delays the regeneration of brush species, past treatments have shown that due to the lack of shrub dominance, the area supports a diverse herbaceous understory, including shrubs which have grown back. With this diversity and understory regeneration a rebound in prey population within a ten year period is expected. Populations may be lower in the interim and thereby impact species that utilize these areas for foraging.

Woody debris would increase in masticated areas and may provide some habitat for mammalian prey species, but decreasing shrub and sapling cover may not provide adequate habitat and foraging for other prey species in the short-term. Fuels treatments (including mastication) have been shown to have positive effects to deer mice (Peromyscus maniculatus), in particular (Converse et al 2006); deer mice increase as tree density decreases.

Postfire populations of shrub nesting birds and foliage gleaners may be reduced until shrub regrowth occurs. Reduced ground cover may benefit granivores and other ground-feeding species. More open canopies that result from fire have been associated with increased populations of aerial insectivores. Open canopies provide room for maneuvers of aerial insectivores. All areas masticated, herbicided, or tractor piled and burned would create more open areas for aerial insectivores and ground feeding species. However, reduction of decaying material in tractor piled and burned units and the 2-10 year delay in returning vegetation may decrease insect abundance within the stands on which these species forage.

Construction and reconstruction of roads to access treatment units has the potential to remove habitat for some sensitive species. However, roads that are reconstructed generally do not contain highly suitable habitat for late-seral dependant species as vegetation on and immediately adjacent to old road beds consists of brush and/or young conifers.

Hand spraying of herbicide reduces chances of direct effects to species in the area. As long as the herbicides are applied according to the directions on the label and following Best Management Practices (BMPs) certified by the state, there should be little risk to wildlife in the area. Glyphosate, and triclopyr are contact herbicides and are both short-lived in the environment.

Herbicide treatments, including ground applications, have the potential to affect the terrestrial wildlife

through direct spray, indirect contamination through ingestion (prey species, vegetation, water), grooming or direct contact with contaminated vegetation. Unintended direct spray would result in an exposure level equivalent to the application rate. Prey species may be contaminated either directly through misapplication onto an individual or through foraging on contaminated plants. It is likely that non-target plants immediately adjacent to the application site may be sprayed directly. Direct spray on any sensitive species examined in this analysis is highly unlikely and would not be addressed in this analysis. However, small mammals, insects and vegetation that have been sprayed can indirectly contaminate sensitive wildlife through ingestion or contact. The response of the organism to the chemical may be slight or delayed, with effect manifested over a range of temporal scales, including the life span of the individual to multiple generations. These exposures are most likely if chemical was present in ground water and subsequently entered surface flow, or if rain events created overland flow and mobilized residual herbicide from leaf surfaces or soil. Chronic and sub-chronic exposure can adversely affect individual growth or the function of certain organs and can have systemic effects with neurological, immunological, endocrine function, reproductive, teratogenic (birth defect), carcinogenic, and mutagenic implications.

Herbicide treatments can affect wildlife species through: 1) acute toxicity, 2) chronic toxicity, and 3) secondary effects upon habitat. Methods used to evaluate risk of herbicide use are discussed above under the Aquatic Wildlife Species section. The risk characterizations for terrestrial animals are limited by the animal and plant species on which data are available compared to the large number of species that could potentially be exposed. This limitation and consequent uncertainty is common to most if not all ecological risk assessments.

The highest exposures for terrestrial vertebrates would occur after the consumption of contaminated vegetation or contaminated insects. Other routes of exposure, like the consumption of contaminated water or direct spray, lead to lower levels of exposure. In chronic exposure scenarios, the estimated daily doses at the upper limits of exposure are associated with highly conservative assumptions regarding the consumption of contaminated vegetation.

The site specific risk assessment highlighted possible impacts to terrestrial insects, mammals and birds with hazard quotients above the level of concern. The site specific risk assessment summary and further analysis for the pesticides is described below.

GLYPHOSATE - This herbicide is generally not known to bio-accumulate in an animal's fatty tissues, therefore, secondary adverse impacts to a species preying on an animal that had been directly exposed to glyphosate is not expected (SERA 2003a, U.S. EPA 1993a & 1993b). Based on the available field studies of the effects of glyphosate on terrestrial animals, at the application levels proposed "direct" toxic effects are unlikely. The effects on terrestrial animals appear to be secondary to changes in habitat resulting from toxic effects on vegetation. In fact, one formulary of glyphosate is registered for aquatic use indicating that it is relatively benign under normal use. In the EPA's Re-registration Eligibility Decision (RED) that was conducted for glyphosate in 1993, the agency found that "based on the current data, it has been determined that effects to birds, mammals, fish and invertebrates are minimal" (U.S. EPA 1993c). The RED goes on to state the following: "Based on the toxicity data and the estimated exposure, it is not expected that endangered terrestrial or aquatic organisms would be affected from the use of glyphosate on the registered uses since the EEC's [Estimated Environmental Concentration] are well below the endangered species criteria (birds = 1/10 LC50, aquatic organisms = 1/20 LC50)(EPA 1993c)."

The central application rate proposed in this project is 4 lb per acre. At this rate and below, the risk characterization for glyphosate does not exceed or meet any level of concern insects, mammals or birds. Assuming that this rate or below is applied to all units, there is not concern for adverse affects from glyphosate within the 1,395 acres proposed for treatment.

However, at the higher application rate (6 lbs a.e./acre), the risk characterization for glyphosate indicates that levels meet or exceed the level of concern for a few of the acute scenarios and one chronic scenario. It meets the level of concern for an acute scenario of a small mammal consuming contaminated vegetation on site. It exceeds the level of concern for the acute direct spray of a honey bee, a large mammal consuming contaminated vegetation on site and a small mammal consuming insects as well as a chronic scenario for a large bird consuming

contaminated vegetation on site. Because this is the highest application analyzed in the risk analysis, and is not the proposed application rate, it would not be assumed to be applied to the complete 1,395 acres. However, it is analyzed as a precaution for the inherent variability in application rates throughout the proposed treatment units.

Acute Scenarios –

In an acute scenario, in which a small and large mammal consumes 100% of their diet (grass) from contaminated vegetation, the levels of concern are just at or just slightly above 1. For a small mammal, the hazard quotient for the acute scenario of consuming contaminated vegetation was 1.0. It is possible that they might consume a large portion of their diet from contaminated vegetation as they are not as likely to move as much over the landscape as large mammals. However, a 100% of contaminated vegetation eaten by small mammals during fall and spring, the application time, is unlikely as seeds, forbs, grasses, and other food items are available that would not be contaminated in the units. Since only brush species would be targeted, this rate of consumption is unlikely. For a small mammal, the estimated dose for consumption under the risk analysis is 172 mg/kg. The NOEL and LOEL for a small mammal is 175 mg/kg and 350 mg/kg respectively (SERA 2003a). The risk assessment LOEL is at least two times higher than the current estimated dose for a small mammal and it is still minimally below the NOEL. Based on these two factors, the unlikely consumption of 100% of vegetation and the dose level in comparison to the NOEL and LOEL, this acute scenario for small

g for the honey bee and is used to model the impacts to terrestrial insects. The hazard quotient for the risk assessment's upper bounds was 1.2, just above the level of unity. The acute dose level was 641 mg/kg. For the honey bee, the NOEC is 540 mg/kg, while the LD50 is 1, 075 mg/kg. The level of dose under the higher application rate is just above the NOEC but still 40% below the LD50. Therefore, in cases where this higher application rate is used, some small terrestrial insects may be impacted by being directly sprayed. However, considering that the higher application rate, not the proposed application rate, it is just above the NOEC, and because the method of spray is focused, this impact would be minimal and should not be a significant concern.

Chronic Scenarios –

For a large bird, the estimated dose for consumption under the risk analysis at the higher application rate is 166 mg/kg/day. The NOEL for a large bird is 100 mg/kg (SERA 2003). As a result, there may be some concern that large birds would be impacted by long term exposure through consumption of vegetation. Large birds (>4 kg) that might be impacted by contaminated vegetation would include species such as the wild turkey (Meleagris gallopavpo). There are not many other large birds that consume vegetation that might be affected in this area. As with all longer term exposure scenarios involving the consumption of contaminated vegetation, the plausibility of this exposure scenario is limited because damage to the treated vegetation – i.e., vegetation directly sprayed at the highest application rate – would reduce and perhaps eliminate the possibility of any animal actually consuming this vegetation over a prolonged period. Also, large birds are not likely to consume dead vegetation. Therefore, chronic effects to large birds from contaminated vegetation are unlikely. An animal under this analysis would have to consume 100% of contaminated vegetation for 90 days. In addition, birds 72 TD[(are likely) (to)4(A)]TJ/TT0 Tf ts 186 TD aminatedctwouldofhso, contaminated 1 Tf 6168 TD[(ve)6(getation)]

vegetation on site and a small mammal consuming insects as well as a chronic scenario for a large mammal and a large bird consuming contaminated vegetation on site.

Because this is the highest application analyzed in the risk analysis, and is not the proposed application rate, it is not assumed to be applied to the complete 125 acres. However, it is analyzed as a precaution for the inherent variability in application rates throughout the proposed treatment units.

For triclopyr, the analysis for glyphosate applies to all the scenarios similarly show to have higher hazard quotients, which include all except the chronic scenario of a large mammal and large bird consuming contaminated vegetation.

Large mammals, such as deer (Odocoileus hemionus), might be impacted by contaminated vegetation over the longer term. The units to be treated would be in the eastern portion of the project area and may be consolidated. Therefore, an animal may have concentrated or repetitive use of contaminated vegetation. However, as with all longer term exposure scenarios involving the consumption of contaminated vegetation, the plausibility of this exposure scenario is limited because damage to the treated vegetation – i.e., vegetation directly sprayed at the highest application rate – would reduce and perhaps eliminate the possibility of any animal actually consuming this vegetation over a prolonged period. An animal under this analysis would have to consume 100% of contaminated vegetation for 90 days. It is unlikely that an animal would consume 100% of contaminated vegetation in treatment units over 90 days. Also, large mammals are not likely to consume dead vegetation (as described previously). In addition, large mammals should be migrating during the fall and early spring when treatments would take place. They are most likely to be moving through areas, consuming a multitude of food items and not just contaminated vegetation as they go. During these times, other food sources are available such as acorns, seeds, young forbs and grasses. Target brush species may be consumed but other species should be available and may be preferred at these times.

For a large mammal, the estimated dose for consumption under the risk analysis at the higher application rate is 76 mg/kg/day. The NOEL and LOEL for a large mammal is 5 mg/kg/day and 25 mg/kg/day (SERA 2003b). Therefore, the estimated dosage of a large mammal consuming 100% of contaminated vegetation is three times the level of the Lowest Observable Effect. This corresponds to the risk characterized at the highest rate of application where the hazard quotient is at 15. At the lowest rate of consumption (10% of their diet came from contaminated vegetation) and application in the risk analysis, there were no adverse impacts. However, at the central rate of consumption (30% of contaminated vegetation consumed), the hazard quotient was slightly above 1 at 1.2. This illustrates that even when consuming a third of its diet with contaminated vegetation a large mammal might be at risk of adverse effects. For all the reasons described above, the risk of concern for triclopyr should be minimal. However, it is possible that exposure to contaminated vegetation may cause adverse effects to large mammals that may utilize these 125 acres.

For a large bird, the estimated dose for consumption under the risk analysis at the higher application rate is 120 mg/kg/day. The NOEL and LOEL for a large bird is 10 mg/kg/day and 20 mg/kg/day (SERA 2003b). Therefore, the estimated dosage of a large bird consuming 100% of contaminated vegetation is six times the level of the Lowest Observable Effect. This corresponds to the risk characterized at the highest rate of application where the hazard quotient is at 12. At the lowest rate of consumption (10% of their diet came from contaminated vegetation) and application in the risk analysis, there were no adverse impacts. However, at the central rate of consumption (30% of contaminated vegetation consumed), the hazard quotient was slightly below 1 at 0.9. This illustrates that even consuming more than a third of its diet with contaminated vegetation a large bird might be at risk of adverse effects. For the reasons described above for glyphosate, the risk of concern for triclopyr should be minimal. However, it is possible that exposure to contaminated vegetation may cause adverse effects to large birds which forage on vegetation that may utilize these 125 acres.

SPORAX - The use of Sporax in the control of annosum root disease does not present a significant risk to wildlife species under most conditions of normal use. Given the limited use through the application of Sporax directly to cut tree stump surfaces, exposures to terrestrial vertebrates are limited to the direct consumption of applied Sporax and ingestion of contaminated water. The most likely and significant risk of toxicity in wildlife species

results from the direct consumption of Sporax applied to tree stumps.

EPA's concerns regarding risks from Boric acid to birds, fish and wildlife species are minimal. They believe that its limited use, low toxicity, and natural presence in the environment are mitigating factors for any potential risk to non-target organisms. Significant amounts of boron are present naturally in soil and water. Surface soil can contain high levels of boron and boron salts can be found in low concentrations in unpolluted surface waterways.

A risk assessment was completed for the use of Sporax by the Forest Service in 2006 (SERA 2006). A site specific risk assessment was completed by the Eldorado National Forest in 2009. The likely exposure scenarios for terrestrial animals considered in this document and the site specific risk assessment are the direct consumption of Sporax applied to tree stumps (acute exposure), consumption of water contaminated by an accidental spill (acute exposure), and acute and chronic exposure by consumption of water contaminated by runoff. The 2006 SERA risk assessment looked at exposure scenarios with values ranging from 0.1 lb/acres to 5 lbs/acres.

With the exception of direct consumption by a large mammal of Sporax applied to tree stumps, none of the exposure scenarios are associated with hazard quotients that meet or exceed the level of concern. The direct consumption scenario only barely met the upper limit hazard quotient.

For the direct consumption scenario, there appears to be very little risk to either mammals or birds. The only HQ to exceed a level of concern is the upper bound of the HQ for the direct consumption of Sporax from a treated stump by a large mammal. However, this is minor with an HQ of 1.1. This HQ is associated with a dose of about 11.5 mg/kg body weight, which is only marginally above the NOAEL of 10.3 mg/kg body weight. Sporax applied to tree stumps does not appear to have attractant effects for deer and no clinical signs of toxicity were observed in deer allowed free access to Sporax-treated stumps (Campbell et al., no date in SERA 2003). The hazard quotients for other organisms – i.e., a small mammal, a small bird, and a large bird – range from 0.00004 to 0.08, below the level of concern by factors of about 12 to 25,000. Risks associated with other exposure scenarios are very low. The risk of exposure via the longer term consumption of contaminated water is characterized only for a small mammal. These risk quotients are very low, ranging from 0.000003 to 0.005 and are below the level of concern by factors of about 200 to over 330,000. (SERA 2003).

The risk assessment does not show any impacts to insects. Given that borax is used in the control of termites, ants and house flies, toxic effects may occur in insects other than honey bees (for which most toxicological data are from). The Fact Sheet (USDA Forest Service 1995) states that borax is relatively non-toxic to bees (LD50 > 362 ppm), while recognizing that high concentrations of boron compounds are toxic to insects, and borax is used for insect control in some cases. It is known that boron compounds have insecticidal properties. US EPA (1993d) states that beneficial insects would not be at risk from the uses of boric acid compounds. Since Sporax is only applied to stumps by the Forest Service and not broadcast sprayed, it is unlikely that there would be widespread exposure to insects. Exposure of insects that are on the treated stump surface may result in toxicity to the individual.

There also does not appear to be a risk to terrestrial plants exposed to boron through runoff of Sporax applied to tree stumps; however, the risk assessment is based on relatively limited toxicity data. Since borax is used effectively in the control of fungi and insects, adverse effects of environmental exposures to non-target insects and microorganisms are possible. Again, however, given the atypical application method for Sporax, widespread exposures are not likely.

Based on this analysis, the risk assessment found that, "the use of Sporax in Forest Service programs would not substantially contribute to or increase concentrations of boron in water or soil beyond those that are associated with the normal occurrence of boron in the environment"(SERA 2003). The proposed dosage of 1 lb/acre falls within this analysis range. Based on this analysis and the above stated reasoning, we conclude that the direct and indirect contamination to animals through the use of Sporax on this project should have no acute or chronic negative effects.

SILICONE/MODIFIED VEGETABLE OIL BLEND SURFACTANTS (SYL-TAC® OR EQUIVALENT) - There is no indication that silicone/modified vegetable oil blend is carcinogenic or mutagenic and there is very little information regarding the

environmental fate of silicone/modified vegetable oil blend. Thus, no reasonable inference on the potential risk to terrestrial wildlife species resulting from the chronic exposure to silicone/modified vegetable oil blend can be made (USDA Forest Service 2003).

There has been concern expressed about the toxicity of silicone-based surfactants on terrestrial insects. Based on a review of the current research (USDA Forest Service, 2007), it would appear that surfactants have the potential to affect terrestrial insects. However, the effect according to research is dose related. Because of the silicone-based surfactants effective spreading ability insects may be more at risk of drowning than toxicological effects. However, silicone surfactants are typically used at relatively low rates because they are effective. Consequently, it is unlikely that insects would be exposed to rates of application that could cause the effects noted in these studies. When considering the need for relatively high doses for a lethal effect, combined with the fact that individuals, not colonies or nests of invertebrates, may be affected, there is little chance that the surfactants could cause widespread effects to terrestrial invertebrates under normal operating conditions. Spills or accidents could result in concentrations sufficiently high to cause effects, depending upon the surfactant.

Few studies exist on the impacts of Syl-Tac® and its component on terrestrial avian and insect species. Therefore, impacts avian species cannot be determined based on the minimal data available. Impacts to insects can only be inferred as can impacts to wild mammals.

COLORFAST® PURPLE - Because the formulation of Colorfast® Purple is proprietary, the concentration of the components is unknown, and the risk of potential exposure rates is difficult to determine (USDA Forest Service 1997). While it is known to be composed of Gentian Violet and dipropylene glycol, the concentrations of each are unknown. It would likely be considered a Category 1 material and have a Danger signal word if it carried one.

Dipropylene glycol is of low acute and chronic toxicity. It is found in many personal care products. It is minor skin and eye irritant. It is not a carcinogen or a teratogen. The acute oral LD50 is 10.6 g/kg (IV) and the acute dermal LD50 is 20.5 g/kg (IV). At high (multi-gram) chronic doses, effects are seen to the kidney and liver. It is of low aquatic toxicity. Because of its low toxicity it should have minimal impacts to terrestrial birds, mammals and insects.

Gentian Violet is of moderate acute toxicity, with a LD50 value of 96 mg/kg (II). Gentian Violet is used as an antifungal or antibacterial medication for dermal or mucous membrane infections. Gentian Violet is a suspected carcinogen, based on tests in mice (Littlefield et al. 1985). Chronic toxicity and carcinogenicity of Gentian Violet was tested in mice and rats (Littlefield et al. 1989). Marked carcinogenic activity was observed in mice, and this study serves as the basis for the quantitative cancer risk assessment for this compound (Littlefield et al. 1985). In rats, there is an indication that the dye accelerates the development of leukemia; however, the effect is less remarkable than that observed in mice (Littlefield et al. 1989). For birds the little research has been done. Turkeys exposed to Basic Violet 3 in drinking water contracted occlusive laryngotracheitis (Clark et al. 1993). The concentration in the drinking water was undetermined; therefore, no reference toxicology data can be inferred.

According to the human health risk analysis done by SERA 1997, there are no exposure effects to workers at the maximum concentration application rate of 0.05% dye/solution. The dose level for workers is expected to be much higher than would be absorbed by small or large mammals. From this analysis, it can be deduced that cancer risk to mammals from dermal exposure would be low. Spills or accidents could result in concentrations sufficiently high to cause effects. Utilizing backpack sprayers should minimize application zones and thus dermal contact. Therefore, it is unlikely that with the recommended application rate and method, there would be any adverse effects to mammals.

SPECIES SPECIFIC EFFECTS

CALIFORNIA SPOTTED OWL –

Of the 16 Protected Activity Centers (PACs) that occur in the project area, two have proposed fuels reduction using mastication or hand thinning (PLA0012 and PLA0066) and six have proposed prescribed burning (PLA0012, PLA0039, PLA0040, PLA0067, PLA0080, PLA0113). Of the 20 Home Range Core Areas (HRCAs) that occur in the project area, two (PLA0008 and PLA0105) are unaffected by treatment units in this project. An additional 10 have minimal amounts of treatment proposed. The remaining nine HRCAs (PLA0010, PLA0011, PLA0012, PLA0040, PLA0043, PLA0067, PLA0080, PLA0109,

and PLA0113) and PLA0036-NP have more than 20% of their mapped area affected by proposed treatments that would likely affect canopy closure. For the purposes of this analysis, prescriptions for thinning, including thinning with additional retention and forest health improvement prescriptions are considered likely to reduce canopy cover and alter stand structure sufficient to have the potential for effects that could linger beyond the immediate treatment and affect overall habitat quality for spotted owls. Treatment prescriptions of non-commercial thinning, mastication and herbicide use are not likely to substantially change the size or overstory canopy closure of the treated stands but may have other indirect effects on habitat. The effects of implementing these prescriptions and other project related activities are described in general and considered for each alternative, related to the potential for disturbance and effects to understory vegetation.

A history of fire suppression and past land management has likely contributed to higher levels of stand diversity that creates habitats known to be selected by spotted owls today. It is difficult to know if spotted owls are dependent upon these contemporary conditions or if they are just exploiting them. Treating stands using thinning prescriptions as proposed by this project reduces some of the stand structure that has developed and thus is presumed to also reduce habitat capability, even though post-treated stands may have stand structures more similar to those that would have occurred in an unaltered fire regime.

It is assumed that spotted owls are sensitive to disturbance during the breeding season within one-quarter mile of active nest sites (USDA Forest Service 2004). Limited Operation Periods (LOP) are designed primarily to protect from disturbance to breeding opportunities, therefore there is a chance that project activities could result in disturbance to individual spotted owls away from activity centers; however the risk of disturbance to individuals is low since the majority of treatments are outside of the 300-acre PACs which have been delineated around core use areas (described in USDA Forest Service 2004 as nest sites, roost sites, and areas which they do a substantial amount of foraging). It is not suspected that there are any unknown territories within the project area. Although individuals may be affected by project activities while foraging, most of the project activities would occur during the daylight hours, which would reduce the risk of disturbance related effects to foraging individuals since owls forage mostly at night and are typically found in their roost sites during the day when activities would occur. It is assumed that reproductively active spotted owls roost primarily within their PACs close to the nest sites, while non-reproductive spotted owls may roost further away from their activity centers. Disturbance to these wider ranging owls would not affect overall population productivity assuming that these owls are non-reproductive for that year.

It is not expected that project activities will result in direct mortality, but disturbance could alter the activities and behavior of individuals potentially contributing to reduced fitness if disturbance affects roosting or foraging opportunities. In the event of disturbance, spotted owls may increase energy expenditures by increased awareness of activities or human presence or by moving to other areas. If spotted owls do move, there is a slight potential for an increased risk of exposure to predators. There could be some indirect effects of disturbance to the extent that it contributes to unpaired status of territories as hypothesized by Seamans and Gutierrez (2007). No studies to date have been able to causally demonstrate this link for thinning at the intensity and extent proposed by this project. Although this alternative applies limited operating periods around activity centers, it could still create disturbance to individual spotted owls but it is not expected that disturbance from this project would have a significant effect on spotted owl populations or distribution. For non-mechanical and non-tree removal activities, this risk is likely similar to that involved with daytime surveys for this species, which have occurred for over a decade with no substantive known risk to survival or productivity.

Great horned owls are a known predator on California Spotted owls, and are thought to inhabit more open forest conditions. Thinning in this project may improve habitat conditions for great horned owls within some treatment units that have the lowest post-treatment canopy cover. The ecological relationship between spotted owls and great horned owls is not well known. It is known that spotted owl behavior changes in the presence of great horned owls but they are known to co-exist in proximity to each other across the landscape in the project area. Thinning may also provide a slight advantage to barred owls, a competitor to California spotted owl that have recently expanded their range and are

known to occur in very low numbers on the Eldorado NF in the project area. The barred owl appears to be a greater habitat generalist than the spotted owl and may be less affected by thinned habitats (Federal Register, 2006). However it should be noted that the barred owl also appears to out-compete the spotted owl in dense habitats as well (Federal Register, 2006).

Mechanical thinning treatments can degrade the quality of spotted owl nesting, roosting, and foraging habitats within treatment units by reducing canopy cover and simplifying vertical structure or canopy layering and disturbing or reducing ground cover. Under Alternative 1, suitable spotted owl nesting and foraging habitat on 3,704 acres of would be treated within the project area, or proportionally 25% of the suitable nesting and foraging habitat within the project area. A total of 2,966 acres of HRCA would be treated of which 2,614 acres is suitable nesting and foraging habitat. Of this total, 2,138 acres of nesting habitat is proposed for thinning or improvement prescriptions of which 1,215 acres of this habitat is in the 70-79% canopy cover class. There is the potential that some of this habitat may decrease in canopy cover such that it may fall below 70% canopy cover and be considered as providing primarily foraging habitat instead of nesting quality habitat. This represents a potential change to 11% of the available nesting quality habitat. There are 601 acres of foraging habitat proposed for thinning or improvement prescriptions of which 191 acres of this habitat is in the 50-59% canopy cover class. There is the potential that some of this habitat may decrease in canopy cover such that it may fall below 50% canopy cover and be considered as low quality foraging habitat, although marking prescriptions and field adjustments are designed to retain 50% canopy cover wherever possible. There are 61 acres of low quality foraging habitat that are in the 40-49% canopy cover class. These are generally smaller mapped habitat patches within larger thinning units and marking prescriptions are generally focused only on surface and ladder fuels within these portions of the treatment units as overstory trees are generally already sufficiently spaced to reduce the risk of crown fire spread.

Treatment units in Alternative 1 contain approximately 301 acres of CWHR 5D and 39 acres of CWHR 5M habitat types. Treatment units 319-10 and 319-15 potentially affect 134 acres of CWHR 5D habitat within HRCAs PLA0040 and PLA0080, which are both highly productive. In addition unit 320-69 potentially affects 28 acres of CWHR 5D in HRCA PLA0113, another highly productive territory. These CWHR 5D habitat patches occur outside of the Protected Activity Centers for these territories. Within these stands, treatments would remove small diameter trees. The treatment of these stands may reduce the short-term habitat quality but since these areas are outside of the current Protected Activity Center, it should not affect nesting opportunities within the PAC. The key structural elements of large trees and large down logs will not be changed by understory thinning treatments and these stands would be expected to serve as future potential nest stands to the extent that cavities and other potential nest structures exist or develop within the larger diameter trees. It is unknown if the physical ground disturbance within the treatment units would affect spotted owl selection of these treated stands for some period of years following treatment.

Recent literature by Seamans and Gutierrez (2007) suggests that spotted owls may be "ideal" in that they settle in the best quality sites available. Their study suggests that there may be a higher probability of breeding dispersal for territories with less than approximately 370 acres of mature forest in a 1,000 acre circle and where greater than 50 acres of mature conifer forest are altered. They note though that mate acquisition may be a confounding factor since a large portion of the individuals in territories that had habitat alteration and dispersal also were unpaired or lost mates prior to dispersal. It was unknown if management activities contributed to the unpaired status or loss of mates. In addition, the selection of the 50 acre threshold was arbitrary but necessary as there were insufficient sample sizes to examine more categories. However, this lack of testing for a specific threshold means that this measure should be used only as an indicator of the potential for breeding dispersal rather than a likelihood of a definitive biological effect. Ideally, probability of breeding dispersal curves would be created examining different thresholds of habitat alteration; however, this information has not been reported in the literature.

Since Seamans and Gutierrez (2007) used a circular area around the nest sites, their conclusions are not completely transferable to HRCAs mapped by the Forest Service, which, although they are also 1,000 acres in size, are defined as the nearest best available habitat on NFS lands within 1.5 miles of the activity center and are not circular in shape. Seamans and Gutierrez did not determine that California Spotted

Owl use circular home ranges, they simply used this area for their statistical analysis to represent a core area of use and to evaluate habitat and activities in direct proximity to activity centers. Some of Seamans and Gutierrez's analysis circles would have included private industrial timberlands, subjected to intensive harvest (clearcuts, shelterwoods, and overstory removal treatments), as well as National Forest System lands, which may have had intensive harvest prior to about 1992 and thinning harvests after 1992. Timber harvest has occurred on private timberlands in the project area. Likely some of the habitat modification in this study on private lands was more intense than the habitat modification proposed in this project, which may have resulted in a greater contribution to dispersal than would be expected in this project. No scientific study has been done to date examining the relationship of owl occupancy and productivity related to habitat within HRCAs as mapped by the Forest Service.

Seamans and Gutierrez found that many (45%) of the territories that dispersed were unpaired or had a loss of a mate in the year prior to dispersal. Since some of the treatments could have occurred on private lands and would not have had a breeding season limited operating period, it's possible that some dispersal was driven by disturbance. In fact, Seamans and Gutierrez suggest that disturbance may have been a stronger motivator of dispersal than the extent of the area altered, although again, mate acquisition may also be an important motivating factor. Seamans and Gutierrez do not indicate if the habitat alteration they measured occurred in close proximity to the activity center or not.

Using the 2005 vegetation inventory data, only one territory (PLA0012; 351 acres) has less than 370 acres of nesting habitat within the 1,000 acre buffer around the territory center considering all ownerships. However, six owl territories contain less than 370 acres of nesting habitat within the 1,000 acre circle surrounding the activity center when considering only national forest system lands (PLA0008 196 acres; PLA0011 370 acres; PLA0012 346 acre; PLA0016 349 acre; PLA0113 274 acre; and PLA0115 328 acre). Of the six territories that start with less than 370 acres of nesting habitat in their core, four have some treatment proposed within them. Of these, only one, PLA0012 has more than 50 acres of treatment proposed in this alternative. Three additional territories (PLA0040, PLA0043, PLA0109) have more than 370 acres of nesting habitat initially, but have more than 50 acres of proposed treatment and would have less than 370 acres of unaffected nesting habitat following treatment.

Given the uncertainty of the relationship of project activities and dispersal, there is a risk that owl occupancy at these sites may be affected as a result of the thinning and improvement treatments. This risk is higher for the six territories (PLA0010, PLA0012, PLA0040, PLA0043, PLA0067, PLA0080) with more than 50 acres of suitable nesting habitat affected by this alternative. In these territories there may be short-term effects on occupancy or reproduction if owls disperse to other areas or other territories. However, since thinning prescriptions are expected to retain 50% post-treatment canopy cover across the treatment units, it is expected that they would continue to provide suitable foraging quality habitat over the long-term and should not result in long-term loss of territory occupancy.

Because of the high density of spotted owl territories within this area, there is a large amount of overlap in adjacent HRCAs. Thus several of the treatment units affect more than one HRCA. In addition to the number of acres treated, the intensity of treatment is considered along with the extent of suitable habitat being affected and remaining following treatment. While treatments themselves are designed to maintain at least minimum habitat requirements by retaining 50% canopy cover wherever possible and at least a 40% canopy cover minimum and by retaining at least 40% of the basal area in the largest trees, it is recognized that treatments would likely result in a short-term reduction in habitat quality, although the exact extent of this effect is scientifically unknown at this time. Studies have only recently been initiated to quantitatively examine the short-term effects of understory thinning on the CSO; however, the sample sizes were too small for meaningful analysis (Gutierrez et al. 2008b). Since 1992, the dominant vegetation management strategy has changed from intensive harvest of larger trees to understory thinning (intensive thinning of the smallest diameter trees with progressively less thinning in trees of increasing diameters and few trees removed greater than 24" dbh) with no removal of large trees (greater than or equal to 30" dbh). This type of thinning prescription has been widely applied in the Eldorado National Forest, including to a limited extent in the project area. Outside of the project area, this thinning has occurred in other areas of the Eldorado Demographic Study Area since the mid-1990's. Even

with this thinning activity, the latest demographic study results suggest that the rate of population change has fluctuated over time but is currently is stable (lambda of 1.00) when examined from 1992 to 2007 (Gutierrez et al. 2009).

Recent research has shown that the highest quality habitat is the most important for reproduction (Gutierrez 2006) and studies have found an association between several stand structure features and owl use areas, including high canopy cover, multiple vegetative layers and a high volume of woody debris (Call et al. 1992, Laymon 1988). North et al. (1999) hypothesized that hunting success would be higher in stands with high tree height diversity since this canopy structure provides spotted owls with perches at all levels in the canopy, facilitating location and capture of prey. Because the resulting canopy cover would be at least 50% and the largest trees would be retained, fuel reduction treatments are expected to maintain suitable habitat, though at a reduced habitat capability level compared to the current condition. [illegible]

cause-effect relationship between the amount of treatment in the mapped HRCAs and changes to territory occupancy and productivity. It seems reasonable to assume; however, that activities and the resultant landscape changes related to treatment of more than 20% of the HRCA could result in short-term effects on territory use for some period of time following project activities that disturb vegetation. Territorial owls would likely find that prey species abundance and distribution would change which may result in different use patterns within the overall home range. Studies have not been conducted to determine if home range use shifts as a result of vegetation treatments, but preliminary field work in the Plumas-Lassen Administrative Study has anecdotally documented some territory shifts from areas that have experienced vegetation treatments to adjacent areas (J.Keane, pers. comm.). The causal agents of the shifts; however, are unknown. Because of the number of highly productive territories affected, there is the potential for a short-term reduction in productivity if the disturbance and short-term habitat changes related to this alternative affects breeding success of these territories. Given that thinning treatments and management activities have occurred on other NFS lands in the EDSA in the last 15 years (Seamans and Gutierrez 2007) and the rate of population change has remained stable and spotted owls generally remain widely distributed across the study area, it is not currently expected that spotted owls would abandon territories. However, annual productivity could be reduced for some number of years following the project completion and this could result in short-term decreases in the annual calculation of lambda (population growth rate) within the Eldorado Demographic Study Area compared to the untreated condition, particularly if productivity is also low in other owl territories in the study area. Since reproductive success varies annually both in terms of proportion of successful nesting attempts as well as numbers of pairs attempting nesting (Gutierrez et al. 2009), the potential effects on annual productivity could be more or less important depending on if it occurred and coincided with years of higher or lower nesting attempts and nesting success.

Since treated areas would retain the core structural elements that define suitable habitat (large trees with moderate to dense canopy cover) and since only minimal treatments in the core nesting habitat (Protected Activity Centers) would occur, it is not expected that these treatments would render affected habitats unsuitable in the short-term or long-term.

NORTHERN GOSHAWK –
The LOP on goshawk nest sites is expected to reduce the potential for nest site failure or abandonment. Although surveys for goshawks have been conducted throughout the project area, they may not have detected all individuals. Project activities have the potential to disturb undiscovered goshawk nests as there is suitable nesting habitat available.

Foraging individuals may also be disturbed by project activities. However, foraging goshawks would have suitable habitat available within the project area for escape from project-related disturbance as only 26% of the suitable habitat available in the project area is proposed for treatment and not all units would have activities occurring at the same time.

Approximately 19 acres of four know PACs would be impacted with proposed treatments, G04-05, G10-03, G10-09 and G10-10. None of these treatments are expected to reduce nesting or foraging habitat area. Foraging habitat may be reduced in quality however. The Activity center for G10-03 is located within 120 ft of a prescribed burn. Since previous studies have noted that prescribe burn only treatments did not reduce the abundance of many prey species, this treatment is not anticipated to impact foraging of goshawks nesting in that PAC the year of burn implementation (Russell et al. 2009, Converse et al. 2006) .

In all, 17 PACs are located within the project area. Of these PACs G04-05, G10-10 and G10-03 would be most impacted by lack of foraging opportunity as they are surrounded by treatment units and are adjacent to private lands which have been previously impacted an may not support abundant prey species populations.

Proposed treatment units contain approximately 3,681 acres of high quality nesting and foraging habitat and approximately 150 acres of moderate quality nesting and foraging habitat for Northern goshawk. Acres of suitable habitat are not expected to be reduced through treatment as CWHR classes are expected to remain constant for the most part. However, foraging habitat may degrade in quality as a result of treatment. These effects are described in the general effects section above.

In is unlikely that changes in prey composition as a result of treatments would impact goshawks beyond 10-20 years. For the interim period there is a potential for decreases in foraging quality from prey species changes, particularly those adjacent to treatment units. However, goshawks are known to be generalist foragers and could switch to prey species that may increase as a result of treatments. This in turn may result in prey changes that do not negatively impact the goshawk.

Additionally, foraging opportunities for goshawk would be enhanced in treatment areas by opening the understory as goshawk are known to prefer open understories for foraging. This allows for greater mobility beneath the canopy and also can increase prey diversity once shrubs and understory return or establish where they have been inhibited. In general a greater number of prey species favor a moderate canopy closure (40 to 69 percent), medium size (<4 acre) openings and a medium to high level of interspersion of seral stages within forest habitats (Reynolds et al. 1992).

Goshawk reactions to prey and foraging mobility changes in units is difficult to predict as no known studies have been done on impacts to goshawks following fuels treatments. Short-term decreases in immigration into the project area, lack of nesting, or lower reproduction may result if impacts are negative. Once understory vegetation recovers, prey species should rebound, and foraging habitat may be of higher quality.

PACIFIC FISHER –
Direct disturbance to Pacific fisher from project activities are not expected as it is unlikely that fisher would be found in the area due to fragmentation of the habitat and high road densities. Planned construction or reconstruction of roads would not increase road density in the area as roads not currently designated as open for public use would be closed after project completion. If there are fishers within the area, the project could disturb a number of individual fishers due to the fisher home range size of 5.78 square miles on average. Most likely only those fishers that might utilize the majority of the project area would be impacted by disturbance which would be around 4-5 individuals.

Treatments in mastication, brush cutting, prescribed burning, thinning, and stand improvement units could disturb fishers if present. These treatments may occur during breeding or young rearing periods or during the summer months, and therefore, could result in the temporary displacement of individual fisher within the project area. If a fisher is present and denning within the project area disturbance could temporarily affect reproduction. Areas where fisher may be denning include 23 areas of treatments. Ninety percent of the existing denning habitat would remain available within the project area. Since only 2% of the identified suitable habitat within the project area is considered denning habitat it is likely that at most 1 or 2 individuals could be impacted.

Foraging individuals could also be disturbed by project activities, however, 73% of the suitable habitat available in the project area is not proposed for treatment. Additionally, not all of units would have activities occurring at the same time, therefore, foraging fisher would have suitable habitat available within the project area for escape from project-related disturbance.

Roads that are reconstructed generally do not contain highly suitable habitat for fisher since vegetation on and immediately adjacent to old road beds consist mainly of brush and/or young conifers. However, these areas could be used for foraging during summer months. Therefore displacement of fisher from these areas could occur. This project is expected to take 1 to 5 years to complete harvesting, mastication, and tractor piling and burning. Roads would be utilized throughout that time period. Although the percentage of the area is minimal, this may impact the use of these areas by fisher, temporarily.

Key habitat characteristics on which fisher depend include higher than average downed woody material, snags, and high canopy cover. The Proposed Action would not decrease the acres of late-seral coniferous forest, most snags, or the CWHR size class of areas, but would reduce canopy cover, downed woody material and snag recruitment. Stand improvement treatments and thinning would result in 3,265 acres of fisher habitat with decreased canopy cover. Denning and restring structures preferred by fisher, such as snags and large down logs may be reduced in the short and long-term on 3,831 acres of fisher habitat proposed for treatment. This may impact foraging, denning and resting opportunities. Habitat within the Old Forest Emphasis would be impacted on 1,179 acres with reduction in canopy cover, snags, and down woody material decreasing habitat characteristics.

Prey species would most likely be altered, and may in some instances decrease due to the reduction in understory cover and downed woody material. These are considered immediate to short-term impacts as described in the General Effects section. Prey species abundance should return within 5-10 years post treatment. Whether this would impact fisher reproduction cannot be determined due to the lack of available studies on such impacts. Fisher can adapt to prey changes and do eat a variety of prey, therefore negative impacts to foraging may be minimal. In the long-term, foraging opportunities for fisher would be enhanced in these areas by increased prey diversity once shrubs and understory return or establish.

It is estimated that 67% of the stand acres proposed for treatment under Alternative 1 are considered suitable for fisher. About 28% of stands proposed for treatment are considered high quality. Only approximately 0.4% is considered denning or resting habitat, which has been described as more limiting. It is projected that areas of high quality habitat with at least 60% canopy cover would, for the most part, be retained where it is currently greater than 60%. Twenty three acres of denning habitat would be impacted with treatment.

For this analysis it is assumed that denning habitat would be reduced to high quality habitat (between 60-80% canopy cover). Thus 10% of the denning habitat would be removed from the project area with the proposed treatment. There is not enough information available on how the removal of denning habitat would affect fisher to determine if this small of a percentage would negatively impact fisher within the project area. The development of denning habitat in the future is expected to be delayed in treatment units as long-term recovery of canopy cover (i.e. over the next 20-30 years) is expected to recover to current levels.

For the project area (including private land) only about 27% of available fisher habitat is proposed for treatment. As these areas regain late seral habitat characteristics that are reduced through treatment, 73% of the project area would maintain future options for fisher colonization.

AMERICAN MARTEN –
Impacts to American marten from harvest activities within the project area are not likely due to the lack of sightings within and adjacent to the project area, despite track plate surveys. Also, the low amount of suitable habitat within the project area and because the suitable habitat is on the lower end of the elevation range for marten, it is unlikely that there are marten in the project area. However, if there are marten within the project area the project may disturb no more than 4 or 5 individual marten due to the size of marten home ranges and the low amount of habitat affected. Project activities of logging operations and road maintenance may occur during breeding or young rearing periods. These activities could result in temporary displacement of individual marten within the project area and may affect reproduction.

Using the 2005 Forest Vegetation Inventory data, approximately 3,800 acres of suitable habitat (CHWR 4M, 4D, 5M, 5D, and 6) is available within the project area. Approximately 53% of the suitable habitat within the project area is within treatment units, or 2,189 acres of suitable habitat. Harvest is anticipated to reduce canopy cover to not less than 60% within most 5D stands. Thus, treatments within 5D stands greater than 70% canopy cover would reduce from denning habitat to suitable habitat. This would affect approximately 205 of the denning habitat within the project area. Whether this may impact marten reproduction cannot be determined due to the lack of available studies on such impacts. Suitable habitat within treatment units is expected to remain suitable, but may be of lower quality for foraging.

In addition to directly impacting habitat quality, the proposed activities may affect habitat for marten prey and thereby reduce the ability of martens to effectively forage. Prey numbers and mass are often similar in harvested and non-harvested stands (Andruski et al. 2008), but may not be equally available to martens in all seasons and cover types. Some prey species would temporarily increase as a result of treatments (see General Effects section). For example, martens use shelterwood stands to forage on ground squirrels (Spemophilus sp.) and chipmunks (Tamias sp.) during the summer, which are expected to increase. During the winter they typically forage heavily on north flying squirrel and Douglas squirrels (Tamiasciurus douglasii) which are associated with more mature and late-seral forests and have been shown to decrease after thinning.

Considering the habitat requirements of the principal prey used by martens in the winter, it is likely that forest thinning would reduce prey available to

martens in the winter, when thermoregulation requires high metabolic and energetic output. However it is not known how much this decrease might impact marten population. Moriarty (2009) indicated that this may be one of the reasons why the marten population in Sagehen Creek Experimental Station declined.

Gaps created in understory thinning units and in 100 acres of the stand improvement units may be beneficial to marten. However, it is anticipated that it would take 7-15 before these openings would contain enough vegetative cover to be of use for marten, based upon regeneration and re-vegetation after similar types of projects.

Harvest activities across the 1,826 acres of marten habitat within thinning and stand improvement units should maintain forested cover at suitable canopy cover. Thinning may reduce habitat quality for marten, but conditions would be within the range of conditions that provide suitable marten habitat, provided adequate levels of ground cover and down logs remain on site. Thinning would increase the vigor of residual trees and may provide long-term benefits to the marten by increasing the amount of cover provided by dominant and co-dominant trees.

The fact that the average 15 inch and greater dbh snags exceeds the level of snags preferred by martens makes it more likely that average snag numbers preferred by martens following burning would be retained as would habitat quality.

PALLID BAT AND TOWNSEND'S BIG-EARED BAT
Activities associated with the Proposed Acton may disturb individuals that could be roosting in hardwoods, snags, or mines within or adjacent to harvest units. Prescribed burns could cause displacement of bats and possible increased risk of mortality due to predation and exposure. Smoke from prescribed burning may also disturb and displace roosting bats during active burning (usually less than two hours of smoke around any given tree). The health effects of smoke on bats are unknown, but the duration, intensity and frequency of exposure from this project is not expected to be substantial. Since prescribed burns occur during the day, displacement of bats could result in increased mortality due to predation and exposure.

Commercial and pre-commercial thinning, brush-cutting, mastication, and prescribed burning may improve foraging habitat for bats by removing "clutter" that can impair echolocation. A dense understory has more structure to bounce sound off thereby masking prey species. A thinned understory would have less "clutter" and would improve foraging conditions for bats; particularly for pallid bats which can forage on large ground dwelling insects. Small openings, such as those created by landings, skid trails, skid roads, and variations in tree harvest across treatment units would provide some openings temporarily (7-15 years) for foraging as well. Gaps created in understory thinning units and in 100 acres of the stand improvement units should be beneficial for foraging. However, treatments may reduce foraging quality for bats in the immediate and short-term as understory brush and herbaceous species and their associated invertebrate fauna are altered or removed. The additive altered or removed. The additive effects of a possible decrease in prey species and an increase in greater foraging mobility is unknown. No studies are known that show the impacts of fuels treatments on bat foraging quality.

Cumulative Effects for Alternative 1

The past treatment units within the cumulative effects area are in various stages of condition, as pre- and post-harvest conditions within the individual stands varied, and harvest occurred over different periods of time. Therefore, these stands are at various stages of recovering the late-seral habitat characteristics as trees continue to grow and canopy cover continues to increase. The treatments since 1989 that occurred on National Forest lands include CASPO understory thinning or prescribed burn projects. Projects performed under the CASPO or SNFPA guidelines are supposed to retain suitable habitat for old forest sensitive wildlife species. While canopy cover, large trees and snags were retained, some treated stands that were degraded the most had little multi-layering and downed woody material preserved through fuels reduction, piling and/or burning.

However, these past fuels reduction projects and the Proposed Action would provide for the improvement and maintenance of sensitive wildlife habitat through decreased risk of stand-replacing wildfire by a return to historic vegetative composition of more pines and oak, less fir and incense cedar on ridgetops. The maintenance of suitable wildlife habitat on lands managed by the Forest Service is particularly important in areas with intermixed private lands as

they are not generally managed to provide habitat for sensitive species.

A variety of vegetation treatments (fuels reduction, clear cutting, and harvesting) occur on private lands within the analysis area. Within the cumulative analysis area 19,900 acres of past activities have occurred on private and public lands. Of this 13,627 acres of harvest and fuels treatments have altered or removed vegetation on private land. These activities appear to have occurred in large blocks within the analysis area; particularly in the northern sections as well as the eastern sections adjacent to the project boundaries. Activities for vegetation management on private lands are regulated by the state and are outside of the jurisdiction of the Forest Service, and may not retain those attributes believed important to sensitive wildlife species.

In a comparison of Eldorado National Forest vegetation data from 1997 to 2005, late-seral habitat has declined from 58,969 to 57,255 acres within 8 years in the 3 mile cumulative effects analysis area. This is a 3% decrease in 8 years. The reduction in late seral habitat within this area is consistent with the Management Indicator Species (MIS) Eldorado Forest analysis (USDA Forest Service 2007) which showed a 11% decrease in late seral habitat throughout the forest from 1992-1997. Present and future activities would add decreased quality impacts to this decreasing acreage trend in late-seral habitat.

Sixty-four percent of the 3-mile cumulative effects analysis area is considered sensitive species habitat. Of this, Alternative 1 would treat 7% of the sensitive species habitat within the analysis area (11% of forest land habitat). Including the Proposed Action, 30% of sensitive species habitat since 1989 has been or would be altered or degraded cumulatively through wildfire or vegetation management activities within the 3-mile analysis area. However, habitat removed before 2005 would not appear as suitable, and thus is not included in this analysis. Therefore, it is likely that greater than 30% of sensitive species habitat was degraded and removed within a 30-year time frame.

Past activities are scattered throughout the area, but with this project large chunks of habitat blocks would be cumulatively impacted. As described above, this project would not add to a decrease in late seral habitat availability in either the short-term or long-term. It should not alter CWHR typing in most cases and therefore, would not alter acres of suitable late seral habitat. However, late seral habitat would be degraded for most late seral dependent wildlife species due to a reduction in old growth characteristics within treated stands. This amount of habitat degraded on the landscape cumulatively would negatively impact late seral dependent wildlife species mainly through reduction in foraging quality as well as denning quality for 5-10 years after treatments are complete. However, long-term increases in quality and quantity of late-seral habitat should diminish the cumulative decrease in late-seral habitat on the forest. In summary, Alternative 1 would increase and protect sensitive species habitat in the long-term, but would degrade habitat in the short-term.

Currently, there are no future foreseeable planned vegetation management projects on Forest Service land within the cumulative effects analysis area. The only future foreseeable vegetation management project within the cumulative effects analysis on private land is the Nevada Point Fuel Break. The Nevada Point Fuel Break is planned on approximately 320 acres and is expected to be implemented within the next year or two on private land. The land manager plans to create a fuel break that would involve commercial thinning and may also remove all trees under 16" dbh; they may or may not remove all understory surface fuels. In the long term, this fuel break would be maintained as part of an intensive forest management program, which may include chemical treatment of brush re-growth. Therefore, old growth characteristics in these stands of multi-layering and large downed woody material would be minimal.

No herbicides have been used within the past ten years or are planned for use in addition to this project in the foreseeable future on public land within this project area. Herbicides on private land are being used in a few plantations on SPI land and a 320 acre future fuel break planned along Nevada Point Road on private land. Within the project area, a total of 26 acres were treated by SPI with 6 qt/ac velpar in November 1996, and 4 qt 2,4-D + 6 qt/ac velpar in October 1999. Since no present or future other herbicide treatments are expected within the project area, there should be minimal cumulative effects to wildlife other than the current treatments proposed.

There are no anticipated cumulative toxicological effects from glyphosate as it is rapidly eliminated from the environment and is not known to

bioaccumulate in birds or mammals. Glyphosate has been applied in recent years on the Eldorado National Forest, particularly in the Cleveland Fire area and it has been used on adjacent industrial timberland. Since there are currently no adverse direct or indirect impacts associated with it is readily eliminated from the environment, there are no expected cumulative toxicological effects.

There are no anticipated cumulative toxicological effects from Sporax as it is readily eliminated from the body and the environment. Sporax has not been applied on the Eldorado National forest previously. Since there are currently no adverse direct or indirect impacts associated with it, and it is readily eliminated from the environment and terrestrial organisms, there are no expected cumulative toxicological effects.

Syl-Tac® is thought to be relatively low risk, and has been described as non-toxic to slightly toxic (USDA Forest Service 2002, 2007). However, surfactants are expected to pose a minimal risk to wildlife at proposed application rates on the 1,395 acres.

Colorfast® Purple dye has been used with the liquid herbicides since the mid- to late-1990s. Because the formulation of Colorfast Purple is proprietary, the concentration of the components is unknown, and the risk of potential exposure rates is difficult to determine, and cumulative effects are also difficult to determine. However, colorants and surfactants are expected to pose a minimal risk to wildlife at proposed application rates on the 1,395 acres.

There should be no cumulative toxicological effects from triclopyr from the chronic consumption of contaminated vegetation by large mammals and large birds. However, at the higher application rates, there could be adverse chronic impacts to large mammals and large birds consuming contaminated vegetation on site.

CALIFORNIA SPOTTED OWL –
Because timber harvest on private lands often does not retain specific habitat characteristics thought to be important for spotted owls, it is likely that California spotted owl are more dependent upon National Forest System lands to provide adequate habitat for their territories. The HRCAs affected by this project have all been evaluated and adjusted to include the best available habitat on National Forest System lands. Thus areas that have had previous treatment and reduced habitat condition and areas that have lower habitat quality were excluded when the HRCAs were mapped. Within the cumulative effects analysis area for the spotted owl, there have been many past actions that altered the vegetation on both private and National Forest lands. Historic timber harvest practices that included the practice of clear-cutting removed some suitable and potentially suitable owl habitat in the past, though it is unknown what habitat existed before these clear cuts were implemented. These areas were reforested and are managed to enhance the growth and survival of planted conifers. Eventually, these plantations would likely develop into suitable owl habitat. Plantations from these clear cuts are all generally at least 10 years old. Plantations also exist following wildfires that are more than 30 years old. All of these varied actions upon the analysis area

from Forest on

currently stable. It is unclear how relevant the findings of Seamans and Gutierrez (2007) are to this project. It is possible that the activities of this project would result in some spotted owls shifting their territories; however, it is not expected that this project would result in a reduction in overall owl populations in the area. The project is not expected to have long-term effects on occupancy or reproduction since post-treatment habitat would still contain the basic structural elements thought to be important for spotted owls as described in the SNFPA. The alternative contributes to a subtle reduction in the current amount of dense forest conditions, which are thought to be important for the California spotted owl, by thinning small and medium trees from forest stands. The treatments would increase the resilience of the treated stands such that they have a higher likelihood of developing into stands dominated by larger and older trees. Thus while there are expected to be short-term reductions in the quality of nesting and foraging habitat, there are expected to be cumulative increases in habitat as a result of reducing the risk of stand loss from wildfire and by reducing inter-tree competition for medium and large trees.

There are no reasonably foreseeable future actions in the project area. However, there are similar projects being contemplated in adjacent areas in the Blacksmith and French House areas. These future projects, if developed, would likely have similar effects, and they would consider this project and the impacts of this project on HRCAs. This may influence the effects analysis of additional treatments that may be planned in HRCAs affected by this project. The amount of timber harvest on private industrial timberlands in this area has likely been affected by the closure of the mill in Camino in 2009, since it substantially increased the distance to the next nearest mill. It is unknown at this point in time to what extent this change would affect the rate and type of harvest that occurs on both private and public lands. The cumulative effects for this project are largely driven by the direct and indirect effects of the project but future contemplated projects may be limited by the lingering cumulative effects of this project. Additional actions such as continued treatment of Annosus mortality patches, mastication or treatment of shrubs, and prescribed burning may occur in the future but no additional projects are currently being planned. This alternative has the greatest potential reduction in fire severity in the event of a wildfire by treating the most acres with treatments that reduce fuels the most. By reducing wildfire risk the most, it has the greatest potential to provide suitable habitat into the future.

The direct, indirect, and cumulative effects are not expected to result in a trend toward Federal listing, as this project affects only a small portion of the species range and considering available data on the status of the California spotted owl throughout its range (Federal Register 2006).

NORTHERN GOSHAWK –
Of the four goshawk PACs that are being impacted by treatments only G10-09 and G10-10 have had previous treatment impacts within the last 10 years. For both PACs, cumulative impacts of past, present and proposed treatments are less than 3%. No future foreseeable treatments are planned within these PACs or other PACS within the cumulative effects analysis area. However, G10-10, G10-03 and G04-05 are almost completely surrounded by past and proposed treatments that have within the past 30 years or will reduce habitat quality for foraging and/or nesting. These PACs most likely will be negatively impacted cumulatively and the proposed project could reduce the likelihood of reproductive success or occupancy. Opening up the understory within 12% of goshawk habitat within the cumulative effects analysis area should eventually benefit foraging opportunities in the long-term.

Based on 2005 vegetation layer, there are 31,493 acres of northern goshawk habitat (25,240 High Capability Habitat acres) within the cumulative effects analysis area. Past activities have impacted 5,666 acres of goshawk habitat in the cumulative effects analysis area since 1989. Of these acres 4,440 acres of vegetation was altered on private land and 1,226 acres on National Forest. Past timber management may have lessened habitat quality by reducing canopy closure and removing larger size class trees that goshawk tend to prefer for nesting. This overall decrease in goshawk habitat suitability is consistent with a previous vegetation analysis from 1992-2005 showing a decrease in goshawk habitat on the Eldorado National Forest.

Future projects like Blacksmith Fuels Reduction Project to the north of Big Grizzly may impact goshawk habitat in a similar manner. However, since no NEPA has been initiated on these projects, no acreage analysis can be completed for future

foreseeable impacts. However, additional treatments may have similar impacts to this project. This could contribute to the possible decline in prey availability in those individual PACs that would have compromised foraging areas through this project.

The 69% of goshawk habitat within the analysis area that remains untreated would likely mitigate for negative temporary impacts due to this large project. However, additional projects that would reduce this percentage within the next 10 years may increase the short-term negative consequences to the northern goshawk population within the analysis area.

Past, present, and future activities would have impacted approximately 9,729 acres (31%) of current goshawk habitat since 1989. This project contributes 39% of the impacts within the analysis area. The current project would not reduce nesting habitat. However, this project may add to the trend of decreasing habitat in the short-term as it may temporarily reduce foraging quality in 12% of goshawk habitat in the cumulative effects analysis area and may delay increases in nesting habitat through canopy cover reduction in short and long-term.

Because Alternative 1 would maintain suitable goshawk habitat, retains 69% of suitable goshawk habitat within the cumulative effects analysis area, reduces the risk of habitat loss due to wildfire, and uses an LOP to minimize disturbance to known goshawk territories, it is not expected to contribute substantially towards adverse cumulative effects to the northern goshawk. The Proposed Action would affect northern goshawk individuals and northern goshawk habitat quality, but the impact is not likely to result in a trend towards federal listing.

PACIFIC FISHER –
Two of the risk factors to the continued existence of fisher in the Sierra Nevada include the risk of habitat loss through catastrophic fire and habitat fragmentation impeding movement and re-colonization (SNSR 1998, Lamberson et al 2000). Past management activities, such as clearcutting and overstory removal in the Big Grizzly Project Area likely negatively impacted fisher habitat. Past projects also impacted foraging quality, denning and resting structures, and canopy cover through understory thinning with effects similar to those described in the direct and indirect sections. The main forest roads through the area may also have impacted this species by removing habitat, creating openings, and providing access for trappers. The cumulative effects of past vegetation management on late seral habitat is discussed above under general effects.

Based on the 2005 vegetation layer, there are 57,255 acres of Pacific fisher habitat within the cumulative effects analysis area. Of this 2,026 acres are suitable for denning and 24,774 are high quality habitat. Past activities have impacted 13,009 acres (24%) of the current fisher habitat in the cumulative effects analysis area since 1989; 228 acres (3%) of this was denning habitat. This is consistent with the decrease in late-seral habitat from 1992 to 2005 on the Eldorado National Forest. Combined with these past projects, the current project would increase the impact to fishers by altering about 7% of suitable and 1% to denning habitat within the cumulative effects analysis area.

Future activities are expected to alter 235 acres (0.4%) of suitable habitat (no denning or high quality habitat would be altered). Future projects like Blacksmith and French House Fuels Reduction Project to the north of Big Grizzly may impact fisher habitat in a similar manner as described above.

Past, present and future activities would alter approximately 16,840 acres (31%) of current fisher habitat since 1989. Two hundred fifty-one acres or 12% of denning habitat would have been altered or removed since 1989. This project contributes approximately a quarter of cumulative impacts in the analysis area.

As described previously, combined with these projects, the current project would not add to the current trend in decreasing fisher habitat area on the landscape. It would negatively impact denning habitat by decreasing denning habitat on the landscape. The decrease in 23 acres of fisher denning habitat would decrease the already minimal amount of denning habitat in the cumulative effects analysis area. The current project may add temporarily to cumulative negative effects in that this project would temporarily reduce foraging quality in 7% of fisher habitat in the analysis area.

Therefore, it may impact some individual home ranges temporarily as previously stated and it may reduce the recruitment of new home ranges temporarily within the project area, but it should increase habitat acreage and quality in the long-term.

While Alternative 1 would maintain suitable fisher habitat in the long-term, retains more than 69% of suitable fisher habitat within the cumulative effects analysis area, and reduces the risk of habitat loss due to wildfire, it would further reduce the already minimal denning habitat and delay the increase in denning habitat on the landscape. Since no fisher are currently believed to occupy the area, and it is believed that only three remaining fisher populations exist in California, the project is not expected to impact a viable fisher population. Because the project is unlikely to impact a viable fisher population, the project is not expected to contribute substantially towards adverse cumulative effects to the fisher. If it did impact individual fishers within the area, the current population trends are stable (USDI2006, and CDFG 2010). However, the proposed project does inhibit the probability of reintroduction of fisher within the area within the short-term. The Proposed Action could affect Pacific fisher individuals and Pacific fisher habitat, but the impact is not likely to result in a trend towards federal listing.

AMERICAN MARTEN –
Currently there is a small amount of intact late-seral habitat that has the potential to provide quality habitat for marten within the cumulative effects analysis area. Sixteen percent of the 89,373 acre cumulative effects area has been identified as suitable American marten habitat (9,454,acres on Forest Service and 5,084 acres on private lands). This habitat is located along the eastern portion of the analysis area.

Past management activities in the Big Grizzly Project Area, such as clear-cutting and overstory removal, likely negatively impacted marten habitat. The main forest roads through the area may also have impacted this species by removing habitat and providing access for trappers. Mainly past projects impacted foraging quality, denning and resting structures, and canopy cover through understory thinning with effects similar to those described in the direct and indirect sections.

Approximately 3,682 acres of vegetation treatments have occurred marten habitat within the cumulative effects analysis area since 1989. Of this 1,624 acres of vegetation treatment occurred on National Forest lands and 2,009 acres occurred on private lands. A total of 186 acres of denning habitat were impacted. In all, 23% of the suitable habitat and 21% of denning habitat in the analysis area was previously impacted.

These vegetation treatments on National Forest lands followed CASPO or SNFPA guidelines, which should have retained suitable marten foraging habitat, but may have reduced preferred denning habitat to foraging habitat or reduced the quality of denning habitat as described for this analysis. This decreased quality is consistent with a decrease in late-seral habitat from 1989-2005 on the Eldorado National Forest.

The Proposed Action would contribute 2,189 acres of vegetation treatment affecting 15% of the available suitable habitat and 4% of available denning habitat within the cumulative effects analysis area. The removal of 40 acres of denning habitat would decrease the already minimal 1% of the analysis area that is currently considered denning habitat and would contribute to the decreasing trend in denning habitat on the forest.

How this small percentage of decrease may impact marten cannot be determined due to lack of information on the percentage of denning habitat required for reproduction. Where previously contiguous forest is fragmented by clear cuts, martens may either relocated, expand their home ranges, or abandon the area. This may be a temporary result of this declining trend in denning habitat. Removal of the forested habitat over 33-55% of the area seems to be the threshold at which marten populations are extirpated (Hargis et al 1999, Potvin et al 2000, Fuller 2006, Webb and Boyce 2009). Since forested habitat within the cumulative effects analysis area has been a combination of removal and thinning on 38% of the area, and since thinning should have retained suitable habitat characteristics, the present project is not expected to reach this threshold of extirpation. Future projects, however, may risk impacts to this population if too much more denning habitat is removed in the near future.

Past, present, and future projects combined would affect approximately 5,918 acres of suitable habitat and 226 acres of denning habitat within the cumulative effects anal91s area. This is 41% of the available suitable and 25% of denning habitat. Within the foreseeable future, fuels reduction project, would follow the 2004 SNFPA guidelines and are thus anticipated to continue to provide suitable marten foraging habitat, though they may reducing

resting/denning habitat quality in the short-term. Therefore 59% (8,683 acres) of suitable marten habitat and 75% (674 acres) of suitable denning habitat within the cumulative effects analysis area is expected remain untreated after all these treatments.

To the degree that this project increases fire resiliency and protects suitable habitat from future wildfires, when considered with other present and foreseeable projects, it may in the long run, increase the amount of habitat that remains available to the marten. Alternative 1 would affect marten individuals and habitat, but the impact is not likely to result in a trend towards federal listing.

PALLID BAT AND TOWNSEND'S BIG-EARED BAT

It is unclear what the cumulative effect of past actions may have been on sensitive bat species in the analysis area. Given the changes in forest vegetation that have been described within the Sierra Nevada over the last 100 years, it is likely that there are less mature hardwoods and denser vegetative conditions between 0 and 8 feet high within mid-elevation stands than there were historically. This would suggest a historic reduction in foraging habitat availability and quality. Historic mining in the area has created more potential roosting habitat for pallid bat and Townsend's big-eared bat than likely occurred prior to European settlement. Timber harvest may have removed existing and future large snags that could have been utilized by bats for roosting, however some mechanical treatments have enhanced future hardwood habitat and opened the understory for foraging opportunities. Clearcuts may have benefited bats as they are found more often in edges and open stands.

Approximately 1,355 acres of vegetation treatments on National Forest lands and 5,423 acres on private lands have occurred within pallid bat and Townsend's big-eared bat habitat in the cumulative effects analysis area since 1989. The vegetation treatments on National Forest lands followed CASPO or SNFPA guidelines. Although key habitat components are maintained within vegetation treatments on National Forest lands, it is likely that some pallid bat roosts have been removed. Activities on private lands do not follow the same guidelines as National Forest lands, and it is likely that private land activities have a greater impact upon pallid bat and Townsend big-ear bat habitat, due to smaller RCA widths and different management goals.

The Proposed Action would affects 5,662 acres of identified bat habitat through vegetation treatment, or 16% of the potential habitat within the cumulative effects analysis area. Understory thinning and prescribed burning would likely improve habitat across the landscape for bats by improving foraging and roosting opportunities. The reduction in risk of future catastrophic fires, promotion of future hardwood habitat, and maintaining open understory over the long term meets several of the conservation measures suggested for bats in the SNFPA (USDA Forest Service 2004).

Within the foreseeable future, no additional acres of suitable habitat would be affected by future fuels reduction projects on the National Forest lands. Future projects on National Forest land (see general effects section), most likely Blacksmith and French House fuels reduction project, would follow the 2004 SNFPA guidelines and are thus anticipated to continue to maintain the same important habitat components, though some pallid bat roost sites may be removed. Most of the fuels reduction projects incorporate oak enhancement aspects, which could slightly improve bat habitat. No caves, mines, or abandoned buildings are anticipated to be altered in the future. Three hundred and twenty acres of potential bat habitat is scheduled for thinning on private lands in the foreseeable future.

Past, present, and future projects combined would affect approximately 12,435 acres of potential habitat for pallid and Townsend's big-eared bat within the cumulative effects analysis area, or 35% of the available habitat. Since the majority of recent past, the proposed, and the foreseeable future vegetation treatments are designed to retain oaks and snags, this project would not substantially contribute to cumulative effects for the pallid bats and Townsend big-eared bats.

Alternative 1 may affect individuals or habitat, but are not likely to result in a trend toward federal listing or loss of species viability for the pallid bat and Townsend's big-eared bat.

ALTERNATIVE 3

Because Alternative 3 would only affect follow up treatment in planted areas and in a majority of the plantation stands proposed for treatment, effects from this alternative are expected to mirror those effects described above in Alternative 1 for

commercial thinning and stand improvement units. Stand density, canopy cover, structure, and species composition are expected to be similar in the treated areas under Alternative 3 to those effects described in Alternative 1.

In non-commercial stands, mastication with no follow-up of herbicide is expected to have limited success in controlling competing brush. Prey species that were impacted by brush removal, would return sooner. Impacts to foraging areas of sensitive wildlife species would be minimal as a result.

Cumulative Effects for Alternative 3

The cumulative effects of Alternative 3 would be very similar as was described above for Alternative 1. However, foraging habitat and prey for sensitive wildlife species would most likely be more abundant in the short-term (<10 years) under Alternative 3 than Alternative 1, which would most likely reduce the impacts of proposed vegetation alteration across the landscape on foraging species. In the long term, late seral habitat may not be reached as quickly due to brush competition in plantation stands. In the short-term, Alternative 3 would slightly reduce the immediate cumulative impact of the proposed treatment but the long-term cumulative effects would be similar under both alternatives.

The direct, indirect and cumulative effects are not expected to result in a trend toward Federal listing, as this project only affects a small portion of the species range and considering available data on the status of the California spotted owl throughout its range (Federal Register 2006). Alternative 3 would affect Northern goshawk individuals and Northern goshawk habitat, but the impact is not likely to result in a trend towards federal listing. Alternative 3 would affect Pacific fisher individuals and Pacific fisher habitat, but the impact is not likely to result in a trend towards federal listing. Alternative 3 would affect marten individuals and habitat, but the impact is not likely to result in a trend towards federal listing. Alternative 3 may affect individuals or habitat, but are not likely to result in a trend toward federal listing or loss of species viability for the pallid bat and Townsend's big-eared bat.

ALTERNATIVE 4

Habitat alteration from treatment described under Alternative 1 would be reduced by not thinning 820 acres and not burning an additional 93 acres. Degradation of identified late seral habitat quality through reduction in large downed woody material and multilayering would be reduced by not treating 792 acres. The reduction in the percent of the land treated would also result in retention of larger blocks of higher quality habitat with old growth characteristics over the landscape, allowing for a less impacted and fragmented landscape for late seral dependent wildlife.

Eighteen treatment units would be completely removed from the project proposal, while several others would be reduced in size and shape. Non-treatment of 913 acres would result in the same impacts described under Alternative 2 within those units or portions of units removed. Habitat quality may increase or decrease depending on future conditions as described under Alternative 2. Non-commercial treatment of small plantations would result in the same habitat impacts as described under Alternative 1.

CALIFORNIA SPOTTED OWL –

Habitat alteration effects are very similar to Alternative 1. The primary difference is the retention of additional mid-story trees in some HRCA treatment units and the retention of additional understory shrubs in some HRCA units. Under Alternative 4, 2,916 acres of suitable spotted owl nesting and foraging habitat would be treated within the project area, or proportionally 20% of the suitable nesting and foraging habitat within the project area would be treated. This is 788 acres of suitable nesting and foraging habitat less than Alternative 1. A total of 2,256 acres of HRCA would be treated; of which 1,946 acres is suitable nesting and foraging habitat. Of this total, 1,399 acres of nesting habitat is proposed for thinning or improvement prescriptions of which 1,075 acres of this habitat is in the 70-79% canopy cover class. There is the potential that some of this habitat may decrease in canopy cover such that it may fall below 70% canopy cover and be considered as providing primarily foraging habitat instead of nesting quality habitat. This represents a potential change to 10% of the available nesting quality habitat. There are 548 acres of foraging habitat proposed for thinning or improvement prescriptions of which 188 acres of this habitat is in the 50-59% canopy cover class. There is the potential that some of this habitat may decrease in canopy cover such that it may fall below 50% canopy cover and be considered as low quality foraging habitat, although marking prescriptions and field adjustments are designed to

habitat would be impacted by Alternative 4. Habitat alteration described under Alternative 1 would be reduced by not treating 283 acres with thinning from below treatments as well as 64 acres of prescribed burning. Alternative 4 would result in impacts on 49% of suitable habitat in the project area. Sixteen percent fewer suitable habitat acres would be impacted as compared to Alternative 1.

PALLID BAT AND TOWNSEND'S BIG-EARED BAT
Direct and indirect effects from Alternative 4 would be similar to those described for Alternative 1. I Alternative 4 would have less of an increase in desirable foraging conditions for pallid bat and Townsend's big-eared bat due to the removal of 908 habitat acres from treatment.

Cumulative Effects for Alternative 4
The cumulative effects of Alternative 4 would be similar to that described above for Alternative 1. Alternative 4 would not degrade foraging habitat for sensitive wildlife species in the short-term to the extent of Alternative 1 with less acres being treated. Alternative 4 would most likely reduce the impacts of proposed vegetation alteration across the landscape on foraging species. In addition, the retention of 792 acres of late seral habitat within Alternative 4 would not add to the decline in total sensitive habitat or quality as described in Alternative 1 in the 3-mile cumulative effects analysis area or in the individual cumulative effects areas for each species discussed above. In the short-term, Alternative 4 would slightly reduce the cumulative impact of the proposed treatment on sensitive species and their habitat as compared with Alternative 1.

Alternative 4 maintains slightly more suitable late seral habitat characteristics, particularly the diversity in stand structure, thermal protection, protection from predators, late seral prey habitat, and providing spotted owls trees foraging activities, as compared to Alternatives 1. Thus, cumulative impacts to HRCAs and home ranges of other sensitive species would also be slightly less than in Alternative 1, which would provide higher quality habitat within the cumulative effects analysis area.

The direct, indirect and cumulative effects are not expected to result in a trend toward Federal listing, as this project only affects a small portion of the species range and considering available data on the status of the California spotted owl throughout its range (Federal Register 2006). Alternative 4 would affect Northern goshawk individuals and Northern goshawk habitat, but the impact is not likely to result in a trend towards federal listing. Alternative 4 would affect Pacific fisher individuals and Pacific fisher habitat, but the impact is not likely to result in a trend towards federal listing. Alternative 4 would affect marten individuals and habitat, but the impact is not likely to result in a trend towards federal listing. Alternative 4 may affect individuals or habitat, but are not likely to result in a trend toward federal listing or loss of species viability for the pallid bat and Townsend's big-eared bat.

ALTERNATIVE 5 (NON-COMMERCIAL ALTERNATIVE)

The direct and indirect effects of the Non-Commercial Alternative would be similar to what was described for Alternative 1 to the extent that the same amount of acres and types of treatments would be implemented in both alternatives. Non-commercial treatment of small plantations would result in the same habitat impacts as described under Alternative 1.

In natural stands, retention of additional trees per acre would be beneficial to late-seral dependant species in the short-term as most tend to prefer greater canopy closure and vertical structure in forested stands. Most of the retained trees contribute to the middle to upper portions of the canopy layers within the units, contributing to a multi-tiered canopy structure. In particular, the intermediate size trees that are generally used for nesting and foraging by raptors would be retained, as many of these intermediate trees are between 16 and 30 inches in diameter.

Species that prefer to nest in trees larger than 30 inches in diameter would not see a difference in preferred trees available for nesting between Alternative 1 and the Non Commercial Alternative; however, when trees greater than 30 inches in diameter are unavailable, occasionally these species do utilize smaller trees. Trees between 12 and 30 inches dbh also provide thermal protection and protection from predators for old forest dependent species and species that avoid edge. For many bird species, including the spotted owl and northern goshawk, spring weather is often a factor in determining reproductive success. Thus, increased protection from weather through denser canopy and

more stand heterogeneity would improve reproductive chances.

Since fewer trees would be harvested across the treatment units, there would be more trees available for snag recruitment. Since the project area generally has more than the desired minimum of 4 snags per acre, increases in snag densities over the long term may or may not provide more quality habitat for snag dependent species.

Wildlife species that utilize structure of fir and incense cedar for mode of travel (flying squirrels) or foraging (California spotted owls) would not be as negatively impacted by the decrease in these species with the Non-Commercial Alternative. The smaller increase in oaks would mean less an increase of foraging quality for species such as bears, deer, and turkey or the increase of habitat for species that utilize large oaks for nesting, resting and denning.

Gaps would not be expanded in stand improvement or created in thinning from below units. The lack of gaps would not allow for an increase in understory diversity within the units and would not provide pockets for prey species within the units. However, mortality from the trees in these pockets would continue to provide cavity nesting habitat for species such as woodpeckers.

Overall, retaining trees between 12 and 30 inches in diameter would result in post-treatment that is of higher habitat quality, through less removal of habitat characteristics, for all old forest dependent species. Retaining higher quality habitat would likely result in less impact of project harvest activities to old forest dependent species present in the project area. The Non-Commercial Alternative provides better post-harvest habitat for old forest dependent species than Alternative 1 in the short-term, but in the very long-term (>20 years) may not provide as high quality of habitat as Alternative 1 across the landscape.

CALIFORNIA SPOTTED OWL

The effects of the Non-Commercial Alternative would be similar to, but variably less than, those described for Alternative 1. Non-commercial treatment units would have the same treatment and the same effects as described for Alternative 1. The use of a 12 inch diameter limit on tree removal would have a variable effect on individual treatment units, dependent upon the unique spatial distribution of existing vegetation above and below the 12 inch diameter size class. The difference in effects when compared to Alternative 1 would primarily be in retention of slightly more mid-level canopy structure, mostly in suppressed and intermediate trees as these were the types of trees in these size classes that were focused on in Alternative 1. This would result in little change in the existing overall multi-layered stand structure from current conditions, with the difference being a few more groups of trees with this characteristic across the treatment units. As most of the treatments are outside of the PACs, this would have little direct benefit to the existing spotted owl territories but may slightly improve roosting and foraging opportunities in the HRCAs by retaining slightly more individual groups of trees with multi-story structure. This may slightly benefit the northern flying squirrel by retaining more vertical structure than Alternative 1. The effects to woodrats would be similar to Alternative 1 because the shrub and surface fuels would be affected similarly by the surface fuels treatments and follow-up prescribed burning.

Because of the 12 inch diameter limitation, gaps to regenerate the disease centers affected by Annosus root disease would not occur in this alternative. These areas would be expected to continue to see white fir mortality resulting in continuing reduction in canopy cover and an increase in snags and eventual down logs. This may provide a slight temporal increase in habitat for species such as woodrats that depend upon abundant slash and down logs, as the pre-dominant white fir continue to die. Over time, these stands are likely to slowly degrade in habitat quality as regenerating white fir would continue to succumb to Annosus root disease. Since large areas along the ridge top are dominated by white fir, the spread of Annosus root disease would slowly fragment this area with areas of lower canopy cover. Since white fir dominated stands with Annosus root disease are most concentrated along the Nevada Point Ridge above the Rubicon River drainage, untreated it could contribute to a greater risk of a future large fire spreading to the north through the project area as a fire burning upslope from the river canyon would reach these areas of potentially higher fuel loading. This could result in larger landscape fragmentation of spotted owl habitat depending upon the extent and severity of future fires. Without future wildfire, the area would be expected to slowly degrade in habitat quality for spotted owls as the canopy cover decreases from mortality of the existing white fir.

The 12 inch diameter limitation would limit

non-snag trees in this size class would likely provide suitable structures for roosting, these potential roost sites would be retained. Also, future snag recruitment in the 12-30 inch diameter range is higher in the Non-Commercial Alternative than in the Proposed Action, thus the amount of future snags available as potential bat habitat is higher.

Cumulative Effects for the Non-Commercial Alternative

Cumulative effects from the Non-Commercial Alternative are expected to be similar to alternative 1, with this project still contributing habitat change across the same acres but at less of intensity as compared to past and future projects on National Forest lands.

The Non-Commercial Alternative may affect individuals or habitat but is not likely to result in a trend toward Federal listing or loss of viability for the California spotted owl. The Non-Commercial Alternative may affect northern goshawk individuals and northern goshawk habitat, but the impact is not likely to result in a trend towards federal listing. The Non-Commercial Alternative may affect Pacific fisher individuals and Pacific fisher habitat, but the impact is not likely to result in a trend towards federal listing. The Non-Commercial Alternative may affect marten individuals and habitat, but the impact is not likely to result in a trend towards federal listing. The Non-Commercial Alternative may affect individuals or habitat, but are not likely to result in a trend toward federal listing or loss of species viability for the pallid bat and Townsend's big-eared bat.

MODIFIED ALTERNATIVE 1

The direct and indirect effects of Modified Alternative 1 would be the same as was described above for Alternative 1 for units that would be treated the same.

Non-treatment of 373 acres that were proposed in Alternative 1 would have similar effects as those described under Alternative 2. Almost all units removed from treatment were late seral (CWHR type 4M/D and 5M/D). Of this 42 acres was 5M/D habitat with >55% canopy cover, the most critical habitat for late seral sensitive species. Not treating these acres of high quality habitat should help reduce impacts to later seral species from the temporary habitat quality decline when compared with Alternative 1.

In units with reduced thinning prescription, 20 acres would be in 5D types that are greater than 60% canopy cover and would reduce the impacts of nesting habitat reduction to sensitive raptors such as goshawks and spotted owls compared to that described in Alternative 1. Additionally, 290 of these altered prescriptions acres are within late seral habitat (4M/D and 5M/D).

The change of 60 acres of proposed thinning from below treatments to prescribe fire only units would reduce the simplification of stand structure and the decrease of snags and downed logs due to the increased retention of trees in the 12-30 inch diameter size class compared to Alternative 1.

CALIFORNIA SPOTTED OWL

Disturbance effects are anticipated to be similar to but slightly lower than Alternative 1, although there would be slightly fewer acres of mechanical harvest resulting in fewer disturbances in some owl territories. The use of LOPs would result in the same mitigation of risk of disturbance to breeding territories.

Habitat alteration effects are similar to, but less than Alternative 1, with the primary difference being the use of smaller diameter limits in some units in HRCAs and deferral of treatment in some units in HRCAs. Under Alternative Modified 1, 3,643 acres of suitable spotted owl nesting and foraging habitat would be treated within the project area, or proportionally 24% of the suitable nesting and foraging habitat within the project area will be treated in this alternative. This is 61 acres of suitable nesting and foraging habitat less than Alternative 1. A total of 2,261 acres of HRCA would be treated, of which 1,817 acres is suitable nesting and foraging habitat. Of this total, 1,250 acres of nesting habitat is proposed for thinning or improvement prescriptions and 1,075 acres of this habitat is in the 70-79% canopy cover class. There is the potential that some of this habitat may decrease in canopy cover such that it may fall below 70% canopy cover and be considered as providing primarily foraging habitat instead of nesting quality habitat. This represents a potential change to 10% of the available nesting quality habitat. This is 462 acres less than Alternative 1. There are 548 acres of foraging habitat proposed for thinning or improvement prescriptions and 188 acres of this habitat is in the 50-59% canopy cover class. There is the potential that some of this habitat may decrease in canopy cover such that it may fall below 50% canopy cover and be considered as low quality foraging habitat, although marking prescriptions and

field adjustments are designed to retain 50% canopy cover wherever possible. There are 57 acres of low quality foraging habitat that are in the 40-49% canopy cover class. These are generally smaller mapped habitat patches within larger thinning units and marking prescriptions are generally focused only on surface and ladder fuels within these portions of the treatment units as overstory trees are generally already sufficiently spaced to reduce the risk of crown fire spread.

Although the acres treated are more similar to Alternative 1, the effects would be more similar to those displayed for Alternative 4. On the 564 acres included in this alternative that are deferred in Alternative 4, the reduced diameter limit on 394 acres will result in slightly fewer mid-story trees being removed. This would retain slightly higher habitat quality than Alternative 1 due to slightly more canopy layering being retained.

As with Alternative 1, eight HRCAs would have more than 20% of the nesting and foraging quality habitat affected by this alternative. This includes 4 HRCAs that have been highly reproductive and are thought to contribute the most to maintaining local population stability. There is no known scientific threshold to determine a cause-effect relationship between the amount of treatment in the mapped HRCAs and changes to territory occupancy and productivity. It seems reasonable to assume; however, that activities and the resultant landscape changes related to treatment of more than 20% of the HRCA could result in short-term effects on territory use. re3c[(Thi)7.1(s)]TJ/9TT10f.455l/TD/Tc.0003>Tj/TT9f2.23/TD.0022Tc(would)Tj/TT9f2.6826/TD/Tc.0003>Tj/TT10f0.02

long-term and should not result in long-term loss of territory occupancy.

NORTHERN GOSHAWK

Effects to northern goshawk habitat are similar to alternative 1, except that 325 acres of habitat would not be impacted. Modified Alternative 1 proposes to impact 3,506 acres of goshawk habitat (3,371 acres of high quality habitat and 123 acres of moderate quality habitat).

The delay in the development of nesting habitat described in Alternative 1 would be lessened on the 481 acres with less simplified stand structure in addition to the retention of the 20 acres of nesting habitat. Trees proposed for retention provide a greater diversity in stand structure, which provides screening to protect goshawks and reproductive areas from predators and weather. However, because the northern goshawk prefers more open stands but detailed information about preferred habitat is conflicting and varied, it is unknown if retaining trees greater than 12 or 16 inches in diameter would result in better, worse, or equal habitat suitability compared to the other action alternatives. Prey species may still be affected initially by treatments due to similar understory reduction, but should return in the long-term.

Depending on the placement of retention pockets of less simplified stands and non-treated stands could reduce the fragmentation of high quality late seral stands on the landscape and keep individual goshawk territories and their surrounding foraging habitat more intact and resilient.

PACIFIC FISHER

Effects to fisher habitat are similar to Alternative 1, except that 325 acres of habitat would not be impacted. Modified Alternative 1 proposes to treat 3,506 acres of fisher habitat (3,483 acres of suitable habitat and 23 acres of denning habitat).

Units will have a less simplified stand structure on 481 acres of which 20 acres of these altered prescriptions would be in 5D types that are greater than 60% canopy cover and would reduce the impacts of denning habitat on fisher compared to that described in Alternative 1. Additionally, 290 of these altered prescriptions acres are within late seral habitat (4M/D and 5M/D) and would allow for a greater canopy cover retention, would retain more larger trees (>16" dbh), and in doing so, would ensure a slightly greater recruitment of large snags and downed logs following treatment than Alternative 1 and therefore should make for higher quality future denning/resting habitat.

The delay in the development of denning habitat, as described in Alternative 1 would be lessened on altered prescription acres in addition to the retention of the 20 acres of 5D habitat; although none of this habitat is currently denning. Modified Alternative 1 would not reduce the number of acres of current denning habitat affected by project activities.

With Modified Alternative 1, 52 acres less of old forest emphasis area would be affected. Prey species may still be affected initially by all treatments due to similar understory reduction, but should return in the long-term.

Depending on the placement, retention pockets of less simplified stands and non-treated stands could reduce the fragmentation of high quality late seral stands on the landscape and keep individual fisher territories and their surrounding foraging habitat more intact and resilient for future relocation attempts.

AMERICAN MARTEN

Effects to marten habitat are similar to alternative 1, except that 137 acres of habitat would not be impacted and suitable habitat would be high in quality post-treatment in about 118 acres. Modified Alternative 1 proposes to treat 2,052 acres of marten habitat (2,012 acres of suitable habitat and 40 acres of denning habitat). Units would have a less simplified stand structure in 40 acres of suitable habitat having a thin with retention and diameter limit change and 78 acres suitable habitat with diameter limit retention change from regular understory thinning.

None of the acres removed from treatment or with altered prescriptions are marten denning habitat therefore there would be no reduction in the impacts of denning habitat on marten compared to Alternative 1. Four acres of 5D in marten habitat would have altered prescriptions. Additionally, 118 of altered prescriptions acres are within late seral marten habitat (4M/D and 5M/D). This should make for higher quality future denning habitat as a result of the increase of important habitat features.

The delay in the development of denning habitat described in Alternative 1 would be lessened on

altered prescription acres. Prey species may still be affected initially by all treatments due to similar understory reduction, but should return in the long-term.

Depending on the placement of retention pockets of less simplified stands and non-treated stands, this could reduce the fragmentation of high quality late seral stands on the landscape and keep individual marten territories and their surrounding foraging habitat more intact and resilient for future relocation attempts.

PALLID BAT AND TOWNSEND'S BIG-EARED BAT
Effects to bat habitat are similar to Alternative 1, except that 535 acres of habitat would not be impacted and some suitable habitat would be high in quality post-treatment in about 481 additional acres. However, the positive impacts to hardwoods would be lessened as a result of the higher canopy cover compared with Alternative 1. Since bats seem to prefer areas for roosting with high oak content, this may actually reduce quality as compared with Alternative 1; but may be offset by higher snag recruitment than Alternative 1. Modified Alternative 1 proposes to treat 5,289 acres of habitat (4,917 acres of suitable habitat and 372 acres of preferred habitat).

Implementation of altered thinning prescriptions is expected to preserve 290 of late seral habitat (4M/D and 5M/D) and should make for higher quality foraging and roosting habitat as a result of the increase of important habitat features.

With Modified Alternative 1, 32 acres less of preferred habitat would be affected compared with Alternative 1. However, development and retention of hardwoods would not be as great under this alternative which may impact potential roosting sites.

Cumulative Effects for Modified Alternative 1

Cumulative effects are the same as for Alternative 1 except that Modified Alternative 1 will contribute less to the simplification of stand structure on the landscape due to the increased retention of trees in the 16-30 inch diameter size class in reduced diameter limit treatment units and in the additional prescribed fire only units. Retention of the most intermediate sized trees in Modified Alternative 1 would provide for a less simplified stand structure in the treatment units, a smaller quality decline in the late seral habitat treated on 403 acres and help provide a larger variety of stand structure on the landscape than Alternative 1. At least 5,000 acres would be impacted with a more simplified stand structure and 28% of the landscape will be cumulatively modified by such treatments. As compared with Alternative 1, which cumulatively modifies 29% of the landscape, there may be little difference to species on a landscape perspective. At the individual level, depending on the placement of treatments, these retention pockets of less simplified stands and non-treated stands could reduce the fragmentation of high quality late seral stands on the landscape and keep individual territories (such as HRCAs) more intact and resilient .

Alternative Modified 1 treats slightly fewer acres of currently suitable habitat and in the short-term maintains slightly more suitable habitat compared to Alternative 1.

3.9 MANAGEMENT INDICATOR SPECIES

Management Indicator Species (MIS) are animal species identified in the Sierra Nevada Forests Management Indicator Species Amendment (SNF MIS Amendment) Record of Decision (ROD) signed December 14, 2007. Guidance regarding MIS set forth in the Eldorado National Forest Land and Resource Management Plan (LRMP) as amended by the 2007 SNF MIS Amendment ROD directs Forest Service resource managers to (1) at project scale, analyze the effects of proposed projects on the habitat of each MIS affected by such projects, and (2) at the bioregional scale, monitor populations and/or habitat trends of MIS, as identified in the Eldorado National Forest LRMP as amended.

ANALYSIS METHODS FOR MANAGEMENT INDICATOR SPECIES

Analysis and disclosure of project-level effects on MIS habitat involves examining the impacts of the proposed project alternatives on MIS habitat by discussing how direct, indirect, and cumulative effects would change the habitat in the analysis area. These project-level impacts to habitat are then related to broader scale (bioregional) population and/or habitat trends. The appropriate approach for relating project-level impacts to broader scale trends depends on the type of monitoring identified for MIS in the LRMP as amended by the SNF MIS Amendment ROD.

Habitats are the vegetation types or ecosystem components required by an MIS species for breeding, cover, and/or feeding. MIS for the Sierra Nevada National Forests represent 10 major habitats and 2 ecosystem components (USDA Forest Service 2007a). These habitats are defined using the California Wildlife Habitat Relationship (CWHR) System. The CWHR System provides the most widely used habitat relationship models for California's terrestrial vertebrate species. Habitat status is the current amount of habitat on the Sierra Nevada Forests. Habitat trend is the direction of change in the amount or quality of habitat over time. Population status is the current condition of the MIS species related to the population monitoring data required in the 2007 SNF MIS Amendment ROD for that MIS. Population trend is the direction of change in that population measure over time.

Habitat monitoring at the bioregional scale is identified for all the habitats and ecosystem components, including the following analyzed for the Big Grizzly Project: Shrubland; oak-associated hardwood & hardwood/conifer; riparian; early seral coniferous forest; mid seral coniferous forest; late seral closed canopy coniferous forest; and snags in green forest. Population monitoring at the bioregional scale for mule deer, yellow warbler, mountain quail, blue grouse, California spotted owl, northern flying squirrel, and hairy woodpecker: Distribution population monitoring consists of collecting presence data for the MIS across a number of sample locations over time (also see USDA Forest Service 2001, Appendix E).

EXISTING CONDITONS

LACUSTRINE/RIVERINE HABITAT CURRENT CONDITION

Within the Big Grizzly Fuels Project area, there are 18 miles of perennial and 143 miles of seasonal streams within the project boundary. Elevations of perennial or seasonal streams within the proposed Big Grizzly Fuels Reduction Project area range from approximately 3,800 feet to 5,500 feet.

The project occurs in portions of two 6th field watersheds, Long Canyon Creek (31,367 acres) and Lower Rubicon River (42,065 acres). The watersheds are mountainous and forested. There are 109 miles of perennial and 490 miles of seasonal streams within the 6th field watersheds that have been identified as the cumulative effects area for aquatic wildlife species.

SHRUBLAND (WEST-SLOPE CHAPARRAL) HABITAT (FOX SPARROW)

The fox sparrow was selected as the MIS for shrubland (chaparral) habitat on the west-slope of the Sierra Nevada. This habitat is comprised of montane chaparral (MCP), mixed chaparral (MCH), and chamise-redshank chaparral (CRC) as defined by the California Wildlife Habitat Relationships System (CWHR).

There are currently 132 acres of montane chaparral and 161 acres of mixed chaparral within the project boundary proposed for treatments. This figure is most likely an underestimate of habitat as some of the less dense areas (1X, 2X, 3P, 4P –acres) within the treatment units probably have montane chaparral habitat in their understory. However, pure, dense stands of shrubland habitat are probably limited to these 293 acres.

OAK-ASSOCIATED HARDWOODS AND HARDWOOD/CONIFER HABITAT (MULE DEER)

The mule deer was selected as the MIS for oak-associated hardwood and hardwood/conifer in the Sierra Nevada. This habitat is comprised of montane hardwood (MHW) and montane hardwood-conifer (MHC) as defined by the California Wildlife Habitat Relationships System (CWHR). Mule deer range and habitat includes coniferous forest, foothill woodland, shrubland, grassland, agricultural fields, and suburban environments. Mule deer migrate seasonally between higher elevation summer range and low elevation winter range. On the west slope of the Sierra Nevada, oak-associated hardwood and hardwood/conifer areas are important winter habitat.

The project area includes range for the Pacific Deer Herd. Based the 2005 Forest Vegetation Inventory, there 5,666 acres of hardwood habitat within the project area, of which 402 acres (7%) are within units proposed for treatment. Oak habitat in the area has been encroached on by conifers, likely as a result of fire suppression over the past century inhibiting reproduction due to the accumulation of a thick duff layer and making it difficult for seedlings to become established.

EARLY AND MID SERAL CONIFEROUS FOREST HABITAT (MOUNTAIN QUAIL)

The mountain quail was selected as the MIS for early and mid seral coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, red fir, and eastside pine) habitat in the Sierra Nevada. Early seral coniferous forest habitat is comprised primarily of seedlings (less than 1" dbh), saplings (1"-5.9" dbh), and pole-sized trees (6"-10.9" dbh). Mid seral coniferous forest habitat is comprised primarily of small-sized trees (11"-23.9" dbh). The mountain quail is found particularly on steep slopes, in open, brushy stands of conifer and deciduous forest and woodland, and chaparral; it may gather at water sources in the summer, and broods are seldom found more than a half mile from water. Much of the early and mid-seral habitat within treatment units and the project area are from plantations. There are 11,486 acres of early and mid-seral habitat within the project area of which 20% is early seral and 80% is mid-seral.

LATE SERAL OPEN CANOPY CONIFEROUS FOREST HABITAT (SOOTY (BLUE) GROUSE)

The sooty grouse was selected as the MIS for late seral open canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, red fir, and eastside pine) habitat in the Sierra Nevada. This habitat is comprised primarily of medium/large trees (equal to or greater than 24 inches dbh) with canopy closures less than 40%. Sooty grouse occupy open, medium to mature-aged stands of conifers, interspersed with medium to large openings, available water, and a mixture of mature habitat types, shrubs, forbs, grasses, and conifer stands. Currently there are approximately 118 acres of late seral open conifer habitats within the Big Grizzly Project area.

LATE SERAL CLOSED CANOPY CONIFEROUS FOREST HABITAT (CALIFORNIA SPOTTED OWL, AMERICAN MARTEN, AND NORTHERN FLYING SQUIRREL)

Three species, the California spotted owl, the American marten and the northern flying squirrel were selected as MIS for late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat in the Sierra Nevada. This habitat is comprised primarily of medium/large trees (equal to or greater than 24 inches dbh) with canopy closures above 40% and multi-layered trees within ponderosa pine and Sierran mixed conifer forests.

The California spotted owl is strongly associated with forests that have a complex multi-layered structure, large-diameter trees, and high canopy closure. It uses dense, multi-layered canopy cover for roost seclusion; roost selection appears to be related closely to thermoregulatory needs, and the species appears to be intolerant of high temperatures. Mature, multi-layered forest stands are required for breeding. The mixed-conifer forest type is the predominant type used by spotted owls in the Sierra Nevada.

American martens prefer coniferous forest habitat with large diameter trees and snags, large down logs, moderate-to-high canopy closure, and an interspersion of riparian areas and meadows. Important habitat attributes are: vegetative diversity, with predominately mature forest; snags; dispersal cover; and large woody debris; they appear to prefer stands with 40 to 60 percent canopy closure for both resting and foraging. Martens generally avoid habitats that lack overhead cover.

The northern flying squirrel occurs primarily in mature, dense conifer habitats intermixed with various riparian habitats, using cavities in mature trees, snags, or logs for cover.

conifer

There are 1,833 acres of suitable late seral closed canopy coniferous forest habitat

intermixed

ponderosa pine vegetation types of the largest snags available (USDA Forest Service 2004). Current snag densities throughout the forest on average are above the minimum requirements in the Sierran Mixed Conifer vegetation type and below the Ponderosa Pine vegetation type. On average, across the treated landscape within the project area, there are approximately 7 snags at greater than 15 inches in diameter within treatment units according to stand exams of selected units.

EFFECTS

ALTERNATIVE 2 (NO ACTION) -

PROJECT-LEVEL EFFECTS ANALYSIS – LACUSTRINE/RIVERINE HABITAT
Effects from ground disturbing actions and herbicide use from this project would not occur with Alternative 2. There would be less chance of soil compaction from heavy machinery in the RCA and less potential for erosion coming from skid roads, and no chance that an accidental herbicide spill to occur from implementing other alternatives. If there was a catastrophic fire as a result of this project not being implemented, then the cumulative effects would potentially be much greater than with Alternatives 1. Depending on fire severity and the number of moist riparian areas affected versus lower order streams which tend to burn hotter, effects to aquatic species may be greater under this alternative.

SHRUBLAND (WEST-SLOPE CHAPARRAL) HABITAT (FOX SPARROW)
Since no new management activities would occur, habitat conditions for mixed or montane chaparral would initially continue to move toward more decadent and dense size and stage classes. Chaparral within stands would continue to compete for resources with understory conifers and overstory canopy cover which would decrease vigor and reproduction over time. Chaparral vegetation within the stands would have increased habitat quality for fox sparrow by being more mature and decadent.

OAK-ASSOCIATED HARDWOODS AND HARDWOOD/CONIFER HABITAT (MULE DEER)
Under the No Action Alternative, no activities would occur in the 402 acres of hardwood habitats within the Big Grizzly project area. Black oak stands would continue to be encroached on and overtopped by competing conifer species, which reduces both mast production and reproduction. This may reduce the quality of this habitat component for mule deer in the project area in the future.

EARLY AND MID SERAL CONIFEROUS FOREST HABITAT (MOUNTAIN QUAIL)
There are no direct or indirect effects to habitat, since no management activities would occur as a result of this alternative. No early or mid seral coniferous habitat would be modified under the No Action Alternative.

LATE SERAL OPEN CANOPY CONIFEROUS FOREST HABITAT (SOOTY (BLUE) GROUSE)
There are no direct or indirect effects to habitat, since no management activities would occur as a result of this alternative. No late seral open canopy coniferous habitat would be modified under the No Action Alternative.

LATE SERAL CLOSED CANOPY CONIFEROUS FOREST HABITAT (CALIFORNIA SPOTTED OWL, AMERICAN MARTEN, AND NORTHERN FLYING SQUIRREL)
There would be no late seral habitat affected by implementation of Alternative 2. However, because there are no activities proposed under this alternative, suitable habitat for this species would be at higher risk of loss due to high severity wildfire.

SNAGS IN GREEN FOREST ECOSYSTEM COMPONENT (HAIRY WOODPECKER)
There are no direct or indirect effects to habitat, since no management activities would occur as a result of this alternative. No snags would be modified under the No Action Alternative but retaining a current basal area would contribute to snag recruitment. If the largest and oldest trees in dense stands left untreated in this alternative are more susceptible to insect attack in times of drought, as was observed in previous droughts, then there could be a decrease in habitat quality in this alternative.

ALTERNATIVE 1 (PROPOSED ACTION)

LACUSTRINE/RIVERINE HABITAT
The direct and indirect effects to aquatic macroinvertebrates that are considered pertain to flow, sedimentation, changes in temperature regime, and changes in water quality. Stream buffers should prevent any loss of riparian vegetation along the banks which protect stream flow and bank stability. Sedimentation is not expected to increase

significantly as a result of the herbicide treatments, machine piling, understory thinning, and mastication on the streams flowing in tributary streams in the project and into Big Grizzly Canyon, Long Canyon, and the Rubicon River. Water temperature is not expected to increase significantly as a result of the activities of the project. Water quality is not expected to change significantly as a result of the herbicide treatments. Water quality is not expected to change as a result of machine piling, mastication, prescribed fire, and thinning treatments because of st

removing surface duff and thus creating a better germination environment for seedling survival.

The change in canopy closure of 402 acres out of 5,666 acres of habitat would not alter the existing stable trend in the habitat.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Mule Deer Trend - The treatment of 402 acres of oak-associated hardwood and hardwood/conifer habitat within the treatment units would not alter the existing stable trend in the habitat, nor would it lead to a change in the distribution of mule deer across the Sierra Nevada bioregion.

EARLY AND MID SERAL CONIFEROUS FOREST HABITAT (MOUNTAIN QUAIL)

Alternative 1 proposes to treat almost 40% of the early to mid-seral conifer habitat within the 22,457-acre Big Grizzly project area; with the majority of treatments being in mid-seral habitat. Understory thinning, and follow-up piling and burning would result in reduced ground level vegetation and a more simplified stand structure compared to what is generally found within early seral habitats. These treatments would result in reduced understory shrub cover in the short-term, which provides hiding cover and shelter for mountain quail.

Short-term suitability of habitat is expected to be decreased due to the delay in growth of grasses and shrubs through follow-up herbicide, piling and prescribe burn treatments. The removal of the built-up surface fuel and decadent brush as well as future prescribed burning should enhance the growth of young brush, grasses and forbs within 10 to 15 years following final treatment. In the long-term, 10 to 15 years post treatment, growth of new shrub and grasses would provide forage and cover opportunities for mountain quail where prescribe burning does not limit its presence.

Species that depend on early and mid-seral trees within stands would have these habitat characteristics decrease immediately and over the short-term across the project area. Early seral species should regain habitat in the understory within 10 to 15 years and would most likely have habitat increase slightly due to gaps created in Stand improvement units. Mid-seral dependent species would continue to have less habitat available within the understory of stands. For mid-seral species the number of acres of habitat would most likely remain constant in the long-term (20 years) as early seral habitat transitions into mid-seral habitat, and mid-seral transitions into late seral.

Small patches of young trees and/or brush that would be retained across the units should provide for escape and hiding cover for wildlife species including mountain quail. Gaps proposed for creation throughout many of the units should increase early seral habitat in the stands and in the project area over the long-term. However, wildlife that inhabits gap areas within Stand improvement and thinning units would be impacted by the conversion of mid-seral to early-seral habitat.

Cumulatively 5,612 acres or 49% of available early and mid-seral habitat within analysis area would be impacted with the Proposed Action. Although past, current, and future activities would maintain basic CWHR habitat qualifications, habitat suitability across 4,529 acres, or 40% of available habitat, is reduced through the removal of understory vegetation. Since the Big Grizzly project affects 40% of the total available habitat within the analysis area, and short- term impacts are adverse, the project is anticipated to substantially affect mountain quail within the project area in the short-term, but not in the long-term.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Mountain Quail Trend - The alteration or reduction of 4,529 acres of early and mid-seral habitat within the treatment units is anticipated to deter from the current slightly decreasing trend in early seral coniferous habitat and would not contribute to the current slightly increasing trend in mid seral coniferous habitat. It is not expected to lead to a change in the distribution of mountain quail across the Sierra Nevada bioregion.

LATE SERAL OPEN CANOPY CONIFEROUS FOREST HABITAT (SOOTY (BLUE) GROUSE)

Alternative 1 proposes to treat almost 86% (101 acres) of the late seral open canopy coniferous forest habitat within the 22,457-acre Big Grizzly project area. Surface fuels would be treated by mastication on 37 acres of habitat proposed for treatment.

Treatment would reduce understory shrub cover in the short term. The removal of the build-up of surface fuel and decadent brush and future prescribed burning should enhance the growth of young brush,

grasses and forbs within ten years following final treatment would be beneficial to sooty grouse as they provide important forage for this species.

Cumulatively 113 acres or 96% of available habitat within the analysis area would be reduced in canopy cover and have its understory opened. This reduction in canopy cover and increase in an open understory maintains suitable habitat and increases quality of habitat for sooty grouse. Since the combination of the Big Grizzly project with past

Relationship of Project-Level Habitat Impacts to Bioregional-Scale California Spotted owl, American Marten and Northern Flying Squirrel Trends.

CALIFORNIA SPOTTED OWL. The potential change in canopy closure of 302 - 335 acres out of 1,833 acres of late seral closed canopy coniferous forest habitat in the Big Grizzly Fuels Reduction Project Area would detract from, but not reverse the existing slightly increasing trend in the habitat. Thirty acres have the potential to change from the highest quality CWHR D canopy class to the lower CWHR M canopy class. The project would not lead to a change in the distribution of California spotted owl across the Sierra Nevada bioregion, due to the small scale of the project compared to the bioregion.

AMERICAN MARTEN. The change in canopy closure in late seral closed canopy coniferous forest habitat described above for the California spotted owl would detract from, but not reverse the existing slightly increasing trend in the habitat. The project would not lead to a change in the distribution of American marten across the Sierra Nevada bioregion, due to the small scale of the project compared to the bioregion.

NORTHERN FLYING SQUIRREL. The change in canopy closure in late seral closed canopy coniferous forest habitat described above for the California spotted owl would detract from, but not reverse the existing slightly increasing trend in the habitat. The project would not lead to a change in the distribution of Northern flying squirrel across the Sierra Nevada bioregion, due to the small scale of the project compared to the bioregion.

SNAGS IN GREEN FOREST ECOSYSTEM COMPONENT (HAIRY WOODPECKER)

Current average snag densities across the Eldorado National Forest are within established guidelines requiring the maintenance of 4 snags per acre in Sierran mixed conifer, Douglas fir, and ponderosa pine vegetation types of the largest snags available (USDA Forest Service 2004). Current snag densities throughout the forest on average are above the minimum requirements in the Sierran Mixed Conifer vegetation type and below the Ponderosa Pine vegetation type. On average, across the treated landscape within the project area, there are approximately 7 snags at >15 inches in diameter within treatment units according to stand exams of selected units. Plantation thinning units do not currently meet the snag numbers required under SNFPA (2004) due to their composition of young trees. Proposed treatments are unlikely to change this inadequacy. However, modeling shows that within 30 years snags should reach the required minimum of 4 snags per acre.

Green snag habitat is proposed for treatment on 4,315 acres within the Proposed Action. However, prescribed burn only, non-plantation thinning and stand improvement thinning would impact snag levels. In total, 3,575 acres of treatment would impact snags (3,073 acres of commercial thinning and stand improvement treatments plus 502 acres of prescribed burning). On average, snag levels on these 3,575 acres (23% of the project area) would remain above 2004 SNFPA guidelines of 4 snags per acre for Westside conifer and hardwood habitats immediately following treatment. Numbers of large diameter snags should not be impacted by commercial thinning, non-commercial thinning, stand improvement treatments or tractor piling other than through hazard tree removal and removal on landings. However, after treatment, fewer potential trees would be available for cavity makers (pileated woodpeckers, etc) that utilize soft decaying trees for cavity making in the immediate and short-term.

Future snag recruitment may be reduced by project activities due improved stand health and protection from fire. However, future snags should be of larger size class, which are likely to be more valuable for hairy woodpecker. Using the Forest Vegetation simulator, projections for future snags illustrate that the number of snags per acre greater than 18 inches in dbh are expected to slightly decrease for approximately 3 decades following project activities, but would remain more abundant than the desired minimum per acre. Trees 16 and 18 inches are not captured with this analysis suggesting large snag averages are more likely slightly higher than those given in the output. It mostly likely would not change the trend in snag decrease, but the number of snags on average would be higher; therefore more snags may be available than the desired minimum per acre as already mentioned.

After approximately 30 years the number of snag per acre are expected to increase as trees continue to age and die, although at a lesser rate than with no project activities. Modeling is believed to most likely under-predict the number of snags that may result over the next several decades as it did not include parameters for the current drought and insect related mortality

that has been evidenced as increasing on the Georgetown Ranger District, and within the project area within the last year. The FVS modeling for the project does not show impacts to large snags with prescribed burning 7-10 years following initial treatment.

The application of fire following thinning results in loss of current large snags as well as in recruitment of live trees to the large snag class (large tree mortality) (Hessburg et al 2010). Thinning alone has been shown to either decrease large snag levels (Hessburg et al 2010) or have no significance difference (Stephens and Moghaddas 2005). Burning alone has been shown to increase large snag levels (>9"dbh, Saab et al 2006), with most of the literature suggesting small diameter snag increases. Estimating the net effect of these changes is difficult because of variations in tree age, size, fuel moisture levels, duff depth, and number/location of snags within the pre-treatment areas. Few studies have been able to show significant impacts to large diameter snags following combined thinning and burning treatments. However, most studies show significant increases to smaller diameter snags after thinning and burning. A study done by Stephens and Moghaddas (2005) in Blodgett Forest within the boundary of the Georgetown Ranger District, following a combined thinning and burning treatment, observed no significant difference in density of snags (for all decay classes) greater than 6 inches dbh in thin/burn treatments when compared to control treatments. Another study, Innes et al (2006) observed a 11-13% decrease in large snags (>17"dbh) in thin/burn treatments, but this decrease was not significant. Both these studies suggest no net change of large snags would occur in our treatments units that are thinned and then burned.

At the potential level of acceptable residual tree mortality from prescribed burning, some large trees would most likely become snags, however whether their numbers are offset by larger snags being consumed by fire or becoming downed logs is unknown. No empirical data is available from previous treatments on the Eldorado National Forest to support any conclusion about snags within previous thin/burn treatments.

Prescribed burning without pre-treatment thinning as prescribed on 502 acres with the Proposed Action, has been shown to increase larger diameter snags(>9"dbh). In Washington, Saab et al. (2006) documented an increase (28.6%) in large snag (>9"dbh) numbers, with overall snag densities doubling, following prescribed fire treatments. In this study, live stems declined overall by 31% with no change in large (>9"dbh) stem densities. Increases in the availability of snags for nesting as well as increases in food resources for bark- and wood-foraging species such as hairy (Picoides villosus) and black-backed (Picoides arcticus) woodpeckers should result in higher densities of these species (Saab et al. 2007). Those stands being prescribed burned only would most likely have more snags available in the short-term for cavity nesting species.

In the short term, Alternative 1 would slightly decrease large snag numbers on 3,073 acres of the project area and increase it on 502 acres. In the long term, snag numbers would be decreased from current projected numbers with no action over a larger area through conversion of fir to pine dominated stands, the removal of diseased and damaged trees, and the associated lower rate of snag recruitment.
Cumulatively this alternative would impact 4,843 acres or 31% of the Green Snag Habitat within the project area. The alteration or reduction of 3,073 acres of green snag habitat within the treatment units is not anticipated to contribute to the current trend lower than recommended snag density in the ponderosa pine vegetation type while not contributing to the higher than recommended snag levels in the mixed conifer vegetation type in the project area. Prescribe burning 502 acres would contribute to increasing snag levels in the mixed conifer and other vegetation types.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Hairy Woodpecker Trend - The alteration or reduction of 3,073 acres of large green snag habitat within the treatment units is not anticipated to contribute to the current bioregional trend of decreasing snag densities in the ponderosa pine vegetation type while not contributing to the increasing bioregional snag levels in the mixed conifer vegetation type. Prescribed burning 502 acres will contribute to the increasing snag levels in the mixed conifer and other vegetation types. It is not expected to lead to a change in the distribution of hairy woodpecker across the Sierra Nevada bioregion.

ALTERNATIVE 3

PROJECT-LEVEL EFFECTS ANALYSIS - LACUSTRINE/RIVERINE HABITAT
Under Alternative 3, effects from ground disturbing actions from this project would be similar to Alternative 1. Cumulative effects from herbicide use would not be an aspect of the project under this alternative. The cumulative effects at the bioregional scale are the same as described for Alternative 1.

SHRUBLAND (WEST-SLOPE CHAPARRAL) HABITAT (FOX SPARROW)
Direct and indirect effects are similar under Alternatives 1 and 3 except shrubs would return sooner on the 30 acres of identified habitat that would have had herbicide under Alternative 1. Effects are similar in that mature stands would be reduced to seedling or sapling. The cumulative effects and their conclusions at the bioregional scale are the same as described for Alternative 1.

OAK-ASSOCIATED HARDWOODS AND HARDWOOD/CONIFER HABITAT (MULE DEER)
Direct and indirect effects are similar under Alternatives 3 to those described for Alternative 1, except that oaks would not benefit as much from reduction in understory shrubs competition on 325 acres of identified habitat that would have had herbicide under Alternative 1.

There is expected to be no difference in the cumulative effects to mixed chaparral habitat within treatment units between Alternative 1 and Alternative 3. The cumulative effects at the bioregional scale are the same as described for Alternative 1.

EARLY AND MID SERAL CONIFEROUS FOREST HABITAT (MOUNTAIN QUAIL)
Direct and indirect effects are similar under Alternative 3 to those effects described for Alternative 1. This alternative results in a decrease in recovery time of understory vegetation on 1,160 acres that would have had herbicide under Alternative 1. Mountain quail habitat would return sooner. The cumulative effects at the bioregional scale are the same as described for Alternative 1.

LATE SERAL OPEN CANOPY CONIFEROUS FOREST HABITAT (SOOTY (BLUE) GROUSE)
Direct and indirect effects from Alternative 3 are similar to Alternative 1 except that 37 acres that would have had herbicide would be masticated instead and shrubs would return sooner. Short-term impacts would reduce understory shrub cover. No acreage changes would be seen in late seral habitat from the immediate implementation of treatments.

The cumulative effects at the bioregional scale are the same as described for Alternative 1.

LATE SERAL CLOSED CANOPY CONIFEROUS FOREST HABITAT (CALIFORNIA SPOTTED OWL, AMERICAN MARTEN, AND NORTHERN FLYING SQUIRREL)
Effects of Alternative 3 are expected to be the same as those described for Alternative 1.

SNAGS IN GREEN FOREST ECOSYSTEM COMPONENT (HAIRY WOODPECKER)
Effects of Alternative 3 are expected to be the same as those described for Alternative 1.

ALTERNATIVE 4

PROJECT-LEVEL EFFECTS ANALYSIS - LACUSTRINE/RIVERINE HABITAT
Under Alternative 4, effects from ground disturbing actions from this project would be similar to Alternative 1, except 820 less acres would be worked. Therefore, there may be slightly less possibility for cumulative effects from the implementation of the project than Alternative 1.

SHRUBLAND (WEST-SLOPE CHAPARRAL) HABITAT (FOX SPARROW)
Direct and indirect effects are similar under Alternatives 1 and 4. The treatments that contain shrubland habitat would differ in 5 acres of shrubland habitat that would remain untreated in Alternative 4. Most of this shrubland habitat to remain untreated is within the "young" shrub size class that would move to a more mature and decadent size class without treatment.

There would be a slight decrease in cumulative effects to chaparral habitat within the project area between Alternatives 1 and 4 because past, present and future cumulative effects to the project units would be reduced by 5 acres. The cumulative effects at the bioregional scale are the same as described for Alternative 1.

OAK-ASSOCIATED HARDWOODS AND HARDWOOD/CONIFER HABITAT (MULE DEER)
Direct and indirect effects are similar under Alternatives 1 and 4. Seventy-six acres of oak associated habitat would remain untreated in Alternative 4. Black oak stands in these 76 acres would continue to be encroached on and overtopped by competing conifer species, which reduces both mast production and reproduction. This may reduce the quality of this habitat component for mule deer in these areas in the future.

There would be a slight decrease in the positive cumulative effects to oak associated habitat within the project between Alternatives 1 and 4, because of the reduction in 76 acres of treatment. The cumulative effects at the bioregional scale are the same as described for Alternative 1.

EARLY AND MID SERAL CONIFEROUS FOREST HABITAT (MOUNTAIN QUAIL)
Direct and indirect effects for Alternative 4 are similar to Alternative 1 except that 718 acres of early and mid seral habitat would remain untreated. The reduction in treatment of 718 acres would slightly decrease cumulative effects to early and mid-seral habitat within the project areas by not reducing understory on these acres. Cumulatively 4,894 acres or 42% of the early and mid seral habitat available would be impacted by Alternative 4.

LATE SERAL OPEN CANOPY CONIFEROUS FOREST HABITAT (SOOTY (BLUE) GROUSE)
Direct and indirect effects of Alternative 4 are the same as Alternatives 1 except 1 acre of late seral open canopy coniferous forest habitat would remain untreated in the proposed treatments for Alternative 4. The cumulative effects at the bioregional scale are the same as described for Alternative 1.

LATE SERAL CLOSED CANOPY CONIFEROUS FOREST HABITAT (CALIFORNIA SPOTTED OWL, AMERICAN MARTEN, AND NORTHERN FLYING SQUIRREL)
Effects to late seral coniferous habitat would be similar to Alternative 1 except 33 fewer acres of Sierran Mixed Conifer 5D would be affected. This is primarily because of changes in units 318-18, 319-10, 319-15, 319-21, and 319-25. Otherwise, the effects are the same as described for Alternatives 1. The cumulative effects at the bioregional scale are the same as described for Alternative 1.

SNAGS IN GREEN FOREST ECOSYSTEM COMPONENT (HAIRY WOODPECKER)
Direct and indirect effects for Alternative 4 are the same as Alternative 1, except that 787 acres of green snag habitat would remain untreated. With Alternative 4, green snag habitat would be impacted on 3,528 acres.

There would be a slight decrease in cumulative effects to green snag habitat within the project are between Alternatives 4 and 1 because of the reduction in treatment by 787 acres. Cumulatively, this alternative would impact 4,796 acres or 31% of the available Green Snag habitat in the project area. The cumulative effects at the bioregional scale are the same as described for Alternative 1.

ALTERNATIVE 5 (NON-COMMERCIAL ALTERNATIVE)

PROJECT-LEVEL EFFECTS ANALYSIS - LACUSTRINE/RIVERINE HABITAT
Direct and indirect effects for the Non-Commercial Alternative expected to be similar to Alternative 1. Reducing the diameter limit of trees proposed for removal is not expected to change sedimentation, flow, but it may allow more stream shade and thereby cooler water temperature in the short term. Warmer water temperatures can affect colonization of macroinvertebrates by making the water inhabitable. However, as most of the stream that are ephemeral in the Big Grizzly project area become dry during summer and the perennial streams already have significant buffers that should prevent affects to stream shade, a difference in effects is not expected to be measurable.

Cumulative Effects for the Non-Commercial Alternative are expected to be similar to Alternative 1. Cumulative effects at the bioregional scale are the same as described for Alternative 1.

SHRUBLAND (WEST-SLOPE CHAPARRAL) HABITAT (FOX SPARROW)
Direct and indirect effects for the Non-Commercial Alternative expected to be similar to Alternative 1. Cumulative effects are expected to the same as in alternative 1. Cumulative effects at the bioregional scale are the same as described for Alternative 1.

OAK-ASSOCIATED HARDWOODS AND HARDWOOD/CONIFER HABITAT (MULE DEER)
Under the Non-Commercial Alternative the same amount of acreage could be affected as in Alternative 1. Effects to habitat are anticipated to be the same as Alternative 1, except with the Non-Commercial Alternative contributing less to increases in oak canopy cover, size and numbers. Removing approximately 50% fewer trees is anticipated to have less of a beneficial effect upon oaks than Alternative 1. Cumulative effects are expected to the similar to Alternative 1 except that the increase in oak associated habitat would be reduced. Cumulative effects at the bioregional scale are the same as described for Alternative 1. The cumulative effect conclusions at the bioregional scale are the same as described for the Proposed Action.

EARLY AND MID SERAL CONIFEROUS FOREST HABITAT (MOUNTAIN QUAIL)
Effects to early and mid-seral coniferous habitat would be the same as in Alternative 1 except canopy cover is anticipated to be reduced less. Retaining 25% more trees in the mid and understory canopy compared to retention with the Proposed Action is expected to retain thermal protection and cover for mountain quail. Understory shrub cover effects are anticipated to be the same as in Alternative 1. However, because gaps are not being created in stand improvement units or thinning units, early seral habitat would not increase. Mountain quail habitat would not increase as a result.

Cumulative effects are expected to be similar to Alternative 1, but negative effects would be less intense in the short-term. The alteration or reduction of 4,529 acres of early and mid-seral habitat within the treatment units would not contribute to the current slightly decreasing trend in early seral coniferous habitat and would not contribute to the current slightly increasing trend in mid seral coniferous habitat. It is not expected to lead to a change in the distribution of mountain quail across the Sierra Nevada bioregion.

LATE SERAL OPEN CANOPY CONIFEROUS FOREST HABITAT (SOOTY (BLUE) GROUSE)
Under the Non-Commercial Alternative the same amount of acreage could be affected as in Alternative 1. Direct and indirect effects are the same under Alternatives 1 and the Non-Commercial Alternative except that canopy cover is anticipated to be reduced less than with the Proposed Action and 25% more trees would be retained in stands. Retaining more trees in the mid and understory canopy would not create as open an understory for sooty grouse. However, the understory would still be opened up through removal of trees less than 12 inches dbh. It is anticipated that this action would be sufficient to improve habitat for sooty grouse in most stands.

Because gaps would not be created in stand improvement units or thinning units, late seral open canopy coniferous forest would remain in the short-term but may decrease in the long-term as a result of tree mortality.

Cumulative effects are expected to be the same as in Alternative 1. The cumulative effect conclusions at the bioregional scale are the same as described for the Proposed Action.

LATE SERAL CLOSED CANOPY CONIFEROUS FOREST HABITAT (CALIFORNIA SPOTTED OWL, AMERICAN MARTEN, AND NORTHERN FLYING SQUIRREL)
Although the acres potentially treated are the same as Alternative 1, the effects to late seral coniferous habitat would be very similar to Alternative 2. The limitation of removal of material only less than 12" dbh would result in limited structural changes to CWHR 5M and 5D habitats as the primary stand structure is comprised of trees greater than 24" dbh.
Cumulative effects are expected to be similar to Alternative 2 due to the minor affects to habitat between the alternatives. There would be no change in the acres of CWHR 5M or 5D as a result of this alternative although the quality of the habitat may be slightly reduced by ground disturbance and removal of shrubs and small diameter trees related to the removal of surface and ladder fuels. The cumulative effect conclusions at the bioregional scale are the same as described for the Proposed Action.

SNAGS IN GREEN FOREST ECOSYSTEM COMPONENT (HAIRY WOODPECKER)
Effects are similar to Alternative 1 except that snags will not likely decrease as much due to treatment. Retaining additional trees would maintain a higher basal area thereby improving snag recruitment. Any snag recruitment from the additional trees per acre between 16 – 29.9 inches dbh would contribute to increasing current snag levels. Because additional diseased or malformed trees in the 16 – 29.9 inch size class may be retained in the Non-Commercial

Alternative, these trees may provide some snag habitat attributes as well.

FVS modeling for this alternative shows on average across the project that snags slightly decrease (from 6 to 5 per acre) following treatment, but do not change after the initial decrease until about 30 years when they start increasing. Increases in snag densities over the long term may or may not provide more quality habitat for snag dependent species

Cumulative effects are expected to be similar to Alternative 1. The Non-Commercial Alternative retains 25% more trees compared to retention with the Proposed Action. Some of these trees would be available for snag recruitment with the higher basal area. Cumulative effects with this alternative are anticipated to be less than the Proposed Action. The cumulative effect conclusions at the bioregional scale are the same as described for the Proposed Action.

MODIFIED ALTERNATIVE 1

PROJECT-LEVEL EFFECTS ANALYSIS - LACUSTRINE/RIVERINE HABITAT

Reducing the diameter limit of trees proposed for removal in some treatment units allows some larger trees to remain as potential future large woody debris to the stream where harvest was proposed within RCA. Large trees falling in the stream improve aquatic habitat complexity creating more available habitat areas with less potential effects on stream shade in the seasonal drainages.

The change in prescription of some parts of units from thinning from below to prescribed fire only reduces potential for sedimentation due to compaction of ground by heavy equipment. Cumulative effects from implementing this alternative would be less than Alternative 1. The cumulative effect conclusions at the bioregional scale are the same as described for the Proposed Action.

SHRUBLAND (WEST-SLOPE CHAPARRAL) HABITAT (FOX SPARROW)

Direct and indirect effects are expected to be similar to Alternative 1. Cumulative effects are expected to be the same as in alternative 1 as treatments that contain shrubland habitat would remain the same. Cumulative effects at the bioregional scale are the same as described for Alternative 1.

OAK-ASSOCIATED HARDWOODS AND HARDWOOD/CONIFER HABITAT (MULE DEER)

Direct and indirect effects are similar under Alternative 1 except that an additional 30 acres of oak associated habitat would remain untreated. These acres will have similar effects as those described under alternative 2. Black oak stands in these 30 acres would continue to be encroached on and overtopped by competing conifer species, which reduces both mast production and reproduction. This may reduce the quality of this habitat component for mule deer in these areas in the future. There would be a slight decrease in positive cumulative effects to oak associated habitat within the project area between Alternative 1 and Modified Alternative 1, because past, present and future cumulative effects to the project units would be reduced by 30 acres and there would be less intense treatment of another 31 acres. The cumulative effect conclusions at the bioregional scale are the same as described for the Proposed Action.

EARLY AND MID SERAL CONIFEROUS FOREST HABITAT (MOUNTAIN QUAIL)

Direct and indirect effects are similar under Alternative 1 on all units treated similarly except 161 acres of early and mid seral habitat would remain untreated in the proposed treatments for Modified Alternative 1. There would be a slight decrease in cumulative effects to early and mid-seral habitat within the project area between alternative 1 and modified alternative 1 because project units would be reduced by 161 acres. The cumulative effect conclusions at the bioregional scale are the same as described for the Proposed Action.

LATE SERAL OPEN CANOPY CONIFEROUS FOREST HABITAT (SOOTY (BLUE) GROUSE)

Direct and indirect effects are the same as Alternatives 1 as 1 acre less would be impacted. There will be a slight decrease in cumulative effects to late seral open canopy coniferous forest habitat within the project area between Alternatives 1 as project units will be reduced by 1 acre of this vegetation type. The cumulative effect conclusions at the bioregional scale are the same as described for the Proposed Action.

LATE SERAL CLOSED CANOPY CONIFEROUS FOREST HABITAT (CALIFORNIA SPOTTED OWL, AMERICAN MARTEN, AND NORTHERN FLYING SQUIRREL)

Although the acres potentially treated are almost the same as Alternative 1 (there would be 10 acres fewer

of CWHR 5D affected), the effects to late seral coniferous habitat would be more similar to Alternative 4. The treatment of most of the units deferred in Alternative 4 with lower diameter limits than in Alternative 1 would retain more mid-story canopy trees which would lessen the change in habitat quality in these units. Since some trees up to 20" dbh could be removed in these units, there would be slightly more potential for structural change than in Alternative 5 in these units, but would not be likely to substantially change structural attributes in CWHR 5M and 5D habitats as the primary stand structure is comprised of trees greater than 24" dbh. The removal of surface fuels and some understory vegetation would reduce the risk of future high severity wildfire effects within the treated units which would result in a higher potential to retain late seral structural elements over time. The retention of slightly more mid-story fuels in units where the diameters are limited to less than 16" dbh would result in slightly more potential for torching of patches of trees than in Alternatives 1 which could kill some older and larger trees. The retention of slightly higher stand density may contribute to higher likelihood of individual tree mortality related to insects and diseases, especially during periods of drought. This could reduce the number of large trees into the future available to become snags and eventual down logs if mature trees are attacked.

Cumulative effects are expected to be similar to those described for Alternative 1 due to the minor (<1%) difference in acres between the alternatives. The treatment in the units in this alternative that are deferred in Alternative 4 would slightly lower habitat quality in those units, but would not change the quantity of CWHR 5M or 5D in the project area. The cumulative effect conclusions at the bioregional scale are the same as described for the Proposed Action.

SNAGS IN GREEN FOREST ECOSYSTEM COMPONENT (HAIRY WOODPECKER)

Direct and indirect effects are the same under Alternatives 1 and Modified Alternative 1 except that 335 acres of green snag habitat would remain untreated with Modified Alternative 1. Additionally, 295 acres of altered prescription acres are within large green snag habitat and would allow for a greater canopy cover retention, would retain more larger trees (>16" dbh), and would provide for slightly greater recruitment of large snags and downed logs following treatment than in Alternative 1.

There would be a slight decrease in cumulative effects to green snag habitat within the project area between Alternatives 1 and Modified Alternative 1 because effects from treatment of units would be reduced by 335 acres. The cumulative effect conclusions at the bioregional scale are the same as described for the Proposed Action.

3.10 AIR QUALITY

AIR QUALITY ANALYSIS

The Big Grizzly project area is located in El Dorado County, CA. Desolation Wilderness, a Class I airshed, is approximately 11 miles to the east. Class I airsheds are areas designated for the most stringent degree of protection from future degradation of air quality.

Placer County is currently in Federal non-attainment status for ozone, a product of volatile organic compounds (VOCs) or nitrogen oxides (NOx). There are no published emission factors that isolate ozone. Standards have been set, though, for the ozone precursors such as hydrocarbons and oxides of nitrogen. Ozone is formed as a result of photochemical reactions involving two types of precursor pollutants: volatile organic compounds (VOC) and nitrogen oxides (NOx). VOC and NOx air pollutants are emitted by many types of sources, including on-road and off-road combustion engine vehicles, power plants, industrial facilities, gasoline stations, organic solvents, and consumer products.

Nonattainment areas are classified as marginal, moderate, serious, severe, or extreme areas depending on the magnitude of the highest 8-hour ozone design value for the monitoring sites in the nonattainment area. The Sacramento region is classified as "Serious" as determined by the Environmental Protection Agency's (EPA) "Green Book Nonattainment Areas For Criteria Pollutants". Threshold values for *de minimis* levels with a serious listing are less than 50 tons/year. The State Implementation Plan has set a level of 25 tons/year.

PM10 (particulate matter < 10 microns) has been established as one of the six criteria pollutants because of adverse human health effects. Even though emission levels are not mandated in the project area for PM10, efforts to reduce PM10 would

be implemented due to the health threat and possible deterioration of visibility to a Class I airshed.

Activities that affect air quality in the project area are: 1) prescribed burning on National Forest lands for reforestation, hazardous fuels reduction, and wildlife habitat improvement; 2) dust from construction and use of unpaved roads and harvest activities; and, 3) wildfire occurrence.

Emission factors data obtained from the Environmental Protection Agency (EPA) is utilized in-conjunction with the amount and type of treatment planned within the project to determine the potential emissions for prescribed fire and harvesting operations for each alternative for comparison(EPA 1996, EPA 1985). Predicted emissions from prescribed burning in the proposed fuels reduction area have been estimated using emission factors from EPA Document 42 and are based on an estimated 90% consumption of machine and hand piles (EPA 1996).

EFFECTS

ALTERNATIVE 2 (NO ACTION)

Under this alternative, no increa inhao(en)4r(o)3.6(n)4(s)]TJ TT9 f2.5689 D c0003>Tj TT9 fTf3976 Doo

MODIFIED ALTERNATIVE 1

Effects with implementation of the Modified Alternative 1 are expected to be similar to those described for Alternative 1.

3.12 ECONOMIC ANALYSIS

COST EFFECTIVENESS

Cost effectiveness, cost efficiency, economic efficiency and other related terms are generally used interchangeably throughout the Record of Decision (ROD) for the Final Supplemental Environmental Impact Statement (FSEIS) for the Sierra Nevada Forest Plan Amendment and within the FSEIS. The most specific definition is provided in the FEIS:

"Cost efficiency, as the term is used here, refers to the number of acres that can be treated for any given budget allocation. The efficiency of a given program mix depends on the extent to which direct project costs can be minimized and offset by project revenues. The cost efficiency of a given management alternative depends upon the prescriptions applied, the number of acres treated, the cost per acre, and the revenues generated by the sale of recovered woody materials." (vol 1, p 222).

The cost of a fuel treatment operation is the sum total of a long list of component costs. These are broadly separated into fixed and variable costs. The basic costs associated with forest operations are relatively easy to quantify. Machine prices are readily available, labor rates can be estimated, interest rates and fuel prices can also be accurately defined, although as the analysis time frame expands, the costs become harder to assess.

COST ASSUMPTIONS

The costs of performing the requisite environmental analysis were considered to be equivalent for all alternatives since the analysis for all alternatives was contained within the same environmental assessment. Reducing or increasing the number of alternatives considered would likely change the costs associated with the over-all environmental assessment, but it is impossible to reasonably quantify the cost of analyzing each individual alternative.

Costs of sale preparation including unit layout are essentially constant in that the cost of performing unit layout, including the flagging, GPSing and boundary posting of all treatment units, does not vary by alternative. It is further estimated that the costs of sale or project administration would remain largely the same because the same acreage of land would require layout, the same number of skid roads and landings would likely be needed, the same roads used for hauling, etc.

In terms of the costs associated with a potential appeal, it is impossible to reasonably predict the relevant costs since each appeal is unique in terms of complexity. The avoidance of an appeal is desirable from a cost and time aspect, however it is impossible to estimate the costs that might be incurred to avoid an appeal, just as it is impossible to quantify the costs of an appeal prior to a potential appeal being presented. Regardless of which alternative is selected an appeal could be filed by a dissatisfied party for any number of reasons. Satisfying the expectations or needs of some segments of the public does not necessarily translate into a decision that would not be appealed. Therefore, it would appear that there is no way of distinguishing a cost difference between alternatives in terms of a potential appeal.

Total costs associated with the planning, preparation, and implementation of any given project or a particular alternative are difficult to confidently determine because no internal, project-specific accounting records are maintained on an individual project basis. Some planning costs are directly related to the size of the project and therefore some activities, such as the amount of time needed for archaeological or biological surveys, etc. varies directly with the project size. However, many of the planning costs are largely fixed in the sense that the time needed to write a biological evaluation on a 1000 acre project would likely be very close to the time required to do the same job on a 100 acre project. These "fixed" costs include the time associated with writing specialist's reports, writing the primary environmental document, IDT meetings, and GIS queries. Other activities such as performing various analyses may include a combination of costs, some of which are dependent upon project size and other costs are largely fixed and not affected by the amount

of acreage treated or the number of alternatives considered.

Road reconstruction needs (costs) are assumed to be a necessary expense regardless of whether commercial or non-commercial operations occur. It is recognized that some reconstruction costs would only be associated with alternatives that include the removal of products via log truck or chip van, however in most instances the needed reconstruction costs are associated with installation or improvement of drainage features (rolling dips, culverts, ditches, etc) that are needed to protect and maintain the existing transportation system. Approximately $250,000.00 in road work cost is assumed for all alternatives in addition to the direct costs of the needed fuels work.

Recognizing the difficulty and inherent inaccuracies of making specific project or alternative cost estimates, the following costs are considered to be reasonable estimates for the Big Grizzly Fuels Reduction Project. This information is based upon experience related to the planning, preparation and implementation of

locally. Contracts are generally awarded to the highest bidder, although stewardship contracts allow for non-price considerations as well and may not always be awarded to the bidder who bid the most for the timber or the least for the stewardship projects.

The Appraised Values do not reflect any potential bid increase (overbid) that might occur during the bidding process. Overbids during the last few years on the Eldorado NF stewardship projects have varied from near 0% to nearly 100%. Because the Big Grizzly project is planned to be advertised next fiscal year, the depressed lumber market is expected to continue to reduce the likelihood of any significant overbids. The fact that the project is located at a mid-elevation where it is not particularly conducive to efficient winter operations may also serve to reduce the likelihood, or amount of over-bid.

STEWARDSHIP WORK COST ESTIMATES:

The cost of the stewardship work is a bid item and the Economic Analysis completed for this project used adjusted costs from similar, fairly recent projects on the Georgetown District. Stewardship bid costs have been experiencing a downward trend since the inception of stewardship contracting on the Eldorado NF, however it appears as though bid prices for stewardship work has now generally stabilized and this downward trend is no longer present.

EFFECTS

ALTERNATIVE 2 (NO ACTION)

The No Action Alternative would not incur cost beyond the expenses already incurred to complete the environmental analysis on the Big Grizzly Project.

ALTERNATIVE 1 (PROPOSED ACTION)

The Proposed Action is expected to generate $630,592 dollars of revenue, however identified road costs would be taken directly from the value of the products removed. With the Proposed Action $380,592 dollars of additional value from the harvest of commercial trees would be available, after the estimated $250,000 dollars of road work associated with the project is accounted for. Additional funding of $3,154,460 dollars required to accomplish all prescribed treatments could come from a variety of sources including appropriated funding, grants, and retained receipts

ALTERNATIVE 3

Alternative 3 is expected to generate the same amount of value from commercial products removed as Alternative 1, however, $220,003 more dollars of additional funding would be required to accomplish all prescribed treatments compared to Alternative 1.

ALTERNATIVE 4

Alternative 4 is expected to generate $712,327 dollars less than Alternative 1. This means that $331,735 dollars of allocated funding, retained receipts or other funding would be needed to remove the commercial products and accomplish the needed $250,000 dollars worth of road work in addition to the money needed to accomplish the prescribed treatments. In all $120,005 more dollars of additional funding would be required than with Alternative 1 in order to accomplish 913 acres less of treatment.

ALTERNATIVE 5 (NON-COMMERCIAL ALTERNATIVE)

Several scenarios to J‘õ‘ó õ2•Ð ý

3-13 HUMAN HEALTH AND SAFETY OF PROPOSED TREATMENT METHODS

ALTERNATIVE 2 (NO ACTION)

Alternative 2 would have no direct effects on human health because no operation of mechanical equipment, hand treatment, or prescribed fire would occur in relation to this project. However, if a wildfire occurs in the project area without fuel treatments, severe wildfire behavior could result in significant adverse indirect and cumulative effects to the health and safety of the public and fire suppression personnel.

ALTERNATIVE 1 (PROPOSED ACTION), ALTERNATIVE 3, ALTERNATIVE 4, ALTERNATIVE 5 (NON-COMMERCIAL ALTERNATIVE), AND MODIFIED ALTERNATIVE 1

MECHANICAL EQUIPMENT

Equipment operators can be injured in several ways. Operators can lose control of machines on steep or slippery terrain; however, such accidents are uncommon among experienced operators. Accidents can occur when operators push brush where visibility is poor, a short headwall or road-cut is encountered, or slope steepness or traction is misjudged. A machine that is out of control can roll over its operator or create hazardous flying debris. Operators can also suffer hearing damage.

Other workers are at risk of being struck by falling trees or pieces of wood or rock thrown out by the equipment, especially during tree cutting and mastication operations. Working on large machines that are slippery from oil or are otherwise hazardous also can cause injuries. Workers other than operators are also at risk of damaged hearing.

Risks to the public from use of mechanical equipment should be negligible. Injuries are possible from accidents when the equipment is being moved on public roads or in rare situations when a member of the public ignores safety warnings and enters a treatment area while equipment is operating.

PRESCRIBED BURNING

Burning creates risk of smoke and heat injury to both workers and the public. Effects on workers range from eye irritation, coughing, and shortness of breath to severe burns that can leave permanent scars or lead to mortality. In addition, chronic exposure of workers to smoke can lead to long-term adverse health effects, such as emphysema or lung cancer.

Smoke may have local, transitory effects on air quality. Sensitive members of the public may experience irritations of the eye, throat, or lung from even the low-level exposures. Risk of adverse chronic health effects on the public from smoke exposure should be lower than risks to workers, because public exposures would be much less than worker exposures.

Prescribed burns may "escape" (burn outside intend areas) and endanger the public. To reduce risks of burn "escapes" and other adverse effects, the Forest Service imposes special requirements for planning and implementing prescribed burns. All prescribed burn projects require preparation of a burn plan, which includes a burning prescription identifying requisite fuel and weather conditions for ignition, burning procedures, and safeguards. Safeguards are precautions needed to confine the burn to the prescribed area. In addition, the Forest Service has established qualification standards and training requirements for personnel involved in prescribed burning.

HAND METHODS

Working with hand tools on steep slopes, and/or unfavorable site conditions is inherently hazardous. Conditions are highly variable, ranging from gentle slopes with vegetation densities to steep slopes with dense tall shrubs or trees. Extremely hot or cold ambient temperatures can occur depending on the time of year. Workers could be cut by tools, struck by falling shrubs or trees, or injured by falling onto sharp stumps or shrub stems. Risk of injuries increases with the amount of work, and are exacerbated when workers are concentrated in areas or fatigued. Injuries can result from minor cuts, sprains, bruises, and abrasions to severe injuries causing major arterial bleeding, compound bone fractures, brain concussions, or mortality.

Hand clearing of vegetation is relatively slow work, with production rates of 2-4 workdays/acre. This exposes workers to the hazards for longer periods in relation to other, more efficient methods of clearing vegetation. Risk of injuries increase as slope, vegetation density, and vegetation height increase.

Other adverse health effects associated with outdoor work in rugged terrain are possible. Examples are extreme fatigue, heat exhaustion or heat stroke, and exacerbation of chronic health conditions.

Proper supervision and effective training for safe use of hand equipment can reduce risks of worker injury. Wearing boots with non-skid soles and snag-resistant long-sleeve shirts and trousers can also reduce risks. Forest Service procedures and normal forestry worker practices involve use of these common safety practices.

Members of the public would not be expected to be at risk from the use of hand methods, because they are not likely to be sufficiently close to work.

HERBICIDE USE

As Alternative 2 (No Action) and Alternative 3 do not propose to use herbicides, this section on Human Health and Safety of Herbicide use is only discussed in terms of Alternatives 1 and 4.

The risk of adverse health effects from the use of either herbicide addressed in this document depends on the level and duration of exposure and the inherent toxicity of the herbicide. Possible short-term adverse health effects include nausea, headache, dizziness, eye irritation, and coughing. Possible long-term effects include cancer, reproductive problems, and heritable mutation.

A Human Health Risk Assessment (project file) was conducted to analyze the potential for adverse health effects in workers and members of the public from the use of herbicide. Workers include applicators, supervisors, and other personnel directly involved in the application of the herbicides. The public includes forest workers who are not directly involved in the herbicide application, and forest visitors who could be exposed through the drift of herbicide spray droplets, through contact with vegetation, or by eating, or placing in the mouth, food items or other plant materials, such as berries or shoots growing in or near treated areas, by eating game or fish containing herbicide residues, or by drinking water that contains residues. The risk assessment examines the potential health effects on all groups of people who might be exposed to any of the two herbicides proposed for use.

The analysis of the potential human health effects associated with the use of chemical herbicides uses the methodology of risk assessments generally accepted by the scientific community (National Research Council, 1983; EPA 1986). In essence, this herbicide risk assessment consists of comparing possible herbicide doses experienced by □placing

a discussion about synergistic effects, sensitive individuals, and cumulative effects.

HAZARD ANALYSIS

A considerable body of information has been compiled in a group of risk assessments completed by SERA (authored by DR. Patrick Durkin, PhD) under contract to the Forest Service. Toxicity information for the surfactants is summarized in USDA 2007. Another source of information for toxicity is the background statements contained in Forest Service Agricultural Handbook No. 633 (USDA 1984). Current peer-reviewed articles from the public scientific literature, as well been

Additives, or adjuvants, to the formulations when herbicides are applied include a surfactant Syl-Tac® or equivalent. Syl-Tac®, which has a "Caution" signal word. It may cause slight skin and eye irritation. Syl-Tac® is of low acute oral and dermal toxicity. Syl-Tac® is a blend of two other products; Hasten®, a vegetable oil based surfactant, and Sylgard® 309, and organosilicone surfactant.

Hasten® has a Caution signal word. Hasten® may be mildly irritating to the skin and to the eyes. The product is of low acute oral and dermal toxicity. The main ingredient in Hasten® is identified in Wilbur-Ellis product information as ethylated corn, canola, and soybean oil (a regulated food additive under 21 CFR 172.515. l). This is combined with sorbitan alkylethoxylate ester as a nonionic surfactant. The polyoxyethylene dialkylester is not sufficiently identified to say anything definite about its composition or toxicity. Hasten® contains ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the (polyoxyethyleneamine) POEA surfactant, refer to Borrecco and Neisess (1991). For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA (2003).

Sylgard® 309 has a Warning signal word. It is

dermal absorption seem to be appropriate for adjusting occupational exposure rates.

Exposure rates are shown as milligrams of chemical per kilogram of body weight per pound of active ingredient (ai) applied. Based on SERA review the estimated typical exposure rate for directed foliar applications involving the use of backpacks or similar devises is 0.003 mg/kg/lb ai, with a range of .003 mg/kg/lb ai, lower to 0.01 mg/kg/lb ai, upper. The exposure of workers is based on the number of hours worked per day, acres treated per hour, and the application rates for the various herbicides. Rather than focus on a single value, each of these factors involves a range of values, which when combined created three levels of exposure (typical, lower, and upper). Typical levels are based on recent experience on the Eldorado National Forest. The upper level is a worst-case level, based on the highest application rates, the least dilution and the largest acreage treated per day. The lower level is used as a lower limit, based on lower applications rates, most dilution, and lowest acres per day treated.

The number of acres treated per hour is taken from recent experiences (1991-2007) on the Eldorado National Forest (ENF). Experience on the ENF for work similar to what is proposed indicates typical production rates of 2.0 acres per day per worker for backpack application. Crew sizes are expected to range from 8 to 12 workers when applying these herbicides. The number of hours worked per day is expressed as a range, 6-8 hours per day in activities that actually involve herbicide exposure.

The application rates planned for each of these herbicides under either Alternative 1 or Alternative 4 are based on previous experience using these herbicides on the ENF. Application rates used in this assessment are shown in Table 5. Rates are expressed as acid equivalents (ae). The typical application rate is 25-30 gallons per acre of herbicide mixture applied.

In general, occupational exposures may involve multiple routes of exposure (oral, dermal, and inhalation); nonetheless, dermal exposure is generally the predominant route for herbicide applicators. Typical multi-route exposures are encompassed by methods used for general exposures. Accidental exposures, on the other hand, are most likely to involve splashing herbicides in to the eyes or onto the skin.

There are various methods for estimating absorbed doses associated with accidental dermal exposure. Two general types of exposure are modeled: 1) those involving direct contact with a solution of the herbicide and 2) those associated with accidental spills of the herbicide onto the surface of the skin. Any number of exposure scenarios could be developed for direct contact or accidental spills by varying the amount or concentration of the chemical contacting the skin and the surface area of the skin that is contaminated. For this risk assessment, two exposure scenarios are developed for each of the two types of dermal exposure, and the estimated dose for each scenario is expressed in units of milligrams of chemical per kilogram body weight (mg/kg).

Exposure scenarios for workers include exposure during normal operations, as well as four accident scenarios: a worker's hands are immersed in the spray mixture for a minute and then washed; a worker wears contaminated gloves for one hour; a worker spills the spray mixture on his/her hands, which are washed after an hour; and a worker spills the spray mixture on his/her legs, which are washed after an hour.

Following the same procedures and using the same non-site-specific data as used in the Sera Risk Assessments, and based on site-specific herbicide-use levels, doses were calculated for potentially exposed workers for each herbicide. The results are displayed in Tables in the Site-Specific Human Risk Assessment (project file).

PUBLIC EXPOSURE – Under normal conditions, members of the general public would not be exposed to substantial levels of either of these herbicides. Members of the public would generally not be in the areas of maintenance work during herbicide application. In addition, posting signs around treatment areas would provide warning to the public that an area is being or has recently been treated.

The proposed units are within or near parts of the Eldorado National Forest used for dispersed recreation, which might include activities such as: woodcutting, hunting, or gathering of plant materials. The public may pass through or near some of these areas while participating in these and other activities. This dispersed use is estimated to be below 10 people a year in any given unit. There are no permanent residences or second homes near the proposed treatment areas.

A variety of exposure scenarios can be constructed for the general public, depending on various assumptions regarding application rates, dispersion, canopy interception, and human activities. Several conservative scenarios are developed for this risk assessment. The two types of exposure scenarios developed for the general public include acute exposure and longer-term or chronic exposure. All of the acute exposure scenarios are primarily accidental. They assume that an individual is exposed to the compound either during or shortly after its application. Specific scenarios are developed for direct spray, dermal contact with contaminated vegetation, as well as the consumption of contaminated fruit, water, and fish. Most of these scenarios should be regarded as extreme, some to the point of limited plausibility. The longer-term or chronic exposure scenarios parallel the acute exposure scenarios for the consumption of contaminated fruit, water, and fish, but are based on estimated levels of exposure for longer periods after application.

Direct Spray - For direct spray scenarios, it is first assumed that during ground application a naked child is sprayed directly and completely covered with herbicide. Obviously, this extremely conservative exposure scenario is virtually implausible. Another scenario involves accidental spraying of the feet and legs of a young woman. For each of these scenarios, assumptions are made regarding the surface area of the skin and the body weight.

For the scenario for dermal exposure from contaminated vegetation, it is assumed that the herbicide is sprayed at a given application rate and that an individual comes in contact with sprayed vegetation or other contaminated surfaces at some period after the spray operation. For these exposures scenarios, estimates of dislodgeable residue and rate of transfer from the contaminated vegetation to the surface of the skin must be made. No such data are directly available for these herbicides, and so estimation methods are used.

Water Contamination – Water can be contaminated by herbicides from runoff, leaching from contaminated soil, drift, or from direct spill. For this risk assessment, two types of scenarios are considered: 1) acute exposure from an accidental spill and 2) chronic exposure to herbicide in ambient water derived from application to a 100-acre treatment area nearby.

There are two acute exposure scenarios. The first scenario assumes that a young child (2-3 years old) consumes contaminated water shortly after an accidental spill of a field solution into a small pond. The second assumes that a small child consumes contaminated water shortly after overland flow or atmospheric drift into a stream. Because these scenarios involve exposure shortly after the water is contamination, no dissipation or degradation of herbicide is assumed.

The scenario for chronic exposure from contaminated water assumes that an adult consumes contaminated, ambient water for a lifetime. Monitoring studies are available for many herbicides that allow estimation of expected concentrations in ambient water resulting from ground application of triclopyr and glyphosate over a wide area.

TABLE 30 PEAK WATER CONTAMINATION RATES FOR HERBICIDES

Herbicide	Peak Water Contamination Rates (mg/L)		
	Central	Lower	Upper
Glyphosate	0.02	0.001	0.4
Triclopyr	0.09	0.001	0.4

Many chemicals may be extracted from water and stored in tissues of animals or plants in the water. This process is referred to as bioconcentration. As with most absorption processes, bioconcentration depends initially on the duration of exposure but eventually reaches a steady state. Generally bioconcentration is measured as the ratio of concentration in the organism to the concentration in the water, referred to the Bioconcentration Factor (BCF). The BCF for fish for both glyphosate and triclopyr for both acute and chronic exposure are below 1. For both the acute and chronic exposure scenarios involving the consumption of contaminated fish, water concentrations of the herbicide that are used are identical to the concentrations use in the contaminated water scenarios. The acute exposure scenario is based on the assumption that an adult angler consumes fish taken from contaminated water shortly after an accidental spill into a pond. No dissipation or degradation of the chemical is considered. Because of the availability of well-documented information about substantial differences in the amount of caught fish consumed by the general public and Native American subsistence populations, separate exposure estimates are made

for these two groups. The chronic exposure scenario is constructed in a similar manner.

Oral Exposure from Contaminated Vegetation – Under normal circumstances and in most types of applications, it is extremely unlikely that humans would consume, or otherwise place in their mouths, vegetation contaminated with these herbicides. Nonetheless, any number of scenarios could be considered, such as accidental spraying of crops, spray of edible wild vegetation such as berries, or the spraying of plants collected by Native Americans for basket weaving or medicinal use. In most instances, particularly for the chronic scenarios, treated vegetation would show signs of damage from herbicide exposure, thereby reducing the likelihood of consumption by humans.

One of the more plausible scenarios involves the consumption of contaminated berries after treatment along a road or some other area in which wild berries grow. The two accidental exposure scenarios developed for this assessment include one scenario for acute exposure and one scenario for longer-term exposure (90-days). In both scenarios the concentration of herbicide on contaminated vegetation is estimated using a derived empirical relationship between application rate and concentration on vegetation.

DOSE – RESPONSE ASSESSMENT

In evaluating the doses received under each scenario, the doses are evaluated against the RfDs as previously discussed. If all the exposures are below the RfD (a HQ less than or equal to 1) the assumption is that the herbicide presents little risk of use to either the public or workers. If any exposure exceeds the RfD, a closer examination of various studies and exposure scenarios must be made to determine whether a toxic response is expected from the exposure. The risk assessment describes the RfDs and their bases. For those herbicides scenarios that involve doses exceeding the RfDs, it provides an analysis of various studies and further refines the risk thresholds. Table 31 displays the acute and chronic RfDs used in the risk assessment.

TABLE 31 REFERENCE DOSES (RFD) OF HERBICIDES

Herbicide	Reference Dose (mg/kg/day)	
	Acute	Chronic
Glyphosate	2.0	2.0
Triclopyr	0.3	0.05

RISK CHARACTERIZATION

A quantitative summary and narrative description of risks to workers and the public from herbicide exposure is presented in this section. The quantitative risk is expressed as the hazard quotient, which is the ratio of the estimated exposure doses to the RfD.

A caution regarding this and any risk assessment is that absolute safety cannot be proven, and the absence of risk can never be demonstrated. No chemical has been studied for all possible effects, and the use of data from laboratory animals to estimate hazard to humans involves uncertainty.

Glyphosate –

WORKERS – Given the low hazard quotients for both general occupational exposures as well as accidental exposures, the results imply that long-term employment applying this herbicide can be accomplished without toxic effects. All worker occupational exposures for the typical, lower and upper application rate result in an HQ of less than 1.

While accidental exposure scenarios are not the most severe one might imagine they are representative of reasonable accidental exposures. For accidental exposure the highest hazard quotient is a factor of about 500 below the level of concern.

The hazard quotients for general occupational exposure scenarios are somewhat higher than those for the accidental exposure scenarios. Nonetheless, the upper limits of the hazard quotient are below the level of concern. As previously discussed, these upper limits of exposure are constructed using the highest anticipated application rate, the highest anticipated number of acres treated per day, and the upper limit of the occupational exposure rate. If any of these conservative assumptions were modified the hazard quotients would drop substantially. The simple verbal interpretation of this quantitative characterization of risk is that even under the most conservative set of exposure assumptions, workers would not be exposed to levels of glyphosate that are regarded as unacceptable.

GENERAL PUBLIC – None of the longer-term exposure scenarios approach a level of concern for the typical application of glyphosate. Although there are several uncertainties in the longer-term exposure assessments for the general public, the upper limits for hazard quotients are sufficiently far below a level of concern except for consumption of contaminated

vegetation by an adult female (HQ=3). This scenario assumes that an adult female would consume 2.96 mg/kg/day of glyphosate for 90 days. As stated above, under normal circumstances and in most types of applications, it is extremely unlikely that humans would consume vegetation contaminated with glyphosate. Again, in most instances and particularly for longer-term scenarios, treated vegetation would probably show signs of damage from exposure to glyphosate, thereby reducing the likelihood of consumption that would lead to significant levels of human exposure. Adequate data are available on glyphosate to estimate the potential impact of such exposures by considering dose-response and dose-severity relationships.
There is a striking concordance between the available human data and animal data. The dose-mortality data in humans is consistent with estimates of oral LD50 values in experimental mammals. For systemic toxic effects, it is generally assumed that population thresholds exist. In other words, below a certain dose, no individual in the population would respond. This assumption is fundamental to risk assessment methods for systemic toxic effects. An analysis in SERA (2003a) yielded an estimate of the human threshold at about 445 mg/kg.

The dose-severity relationships for experimental mammals and humans are also similar. Again from SERA (2003a), animal data were categorized using four standard severity levels: NOEL (no observed effect level), NOAEL (no observed adverse effect level, AEL (adverse effect level), and FEL (frank effect level). The results of this analysis indicate that the probability of an adverse effect at the RfD of 2mg/kg/day is 0.006. This analysis suggests that the current RfD is highly protective. The four category analysis can be used to estimate the probability of observing effects that would be classified as frank signs of toxicity. These effects are sufficiently severe that they can be observed in the whole organism without the use of invasive methods.

The significance of the analysis on animal and the available human data relates to the use of the uncertainty factor. The current RfD uses and uncertainty factor of 10 for species to species extrapolation (i.e. extrapolating from experimental animals to humans). This is a common default procedure. For glyphosate, however, the available data suggests that humans are no more sensitive to glyphosate than experimental mammals. This in turn suggests that the current RfD may be overly protective by a factor of 10. In other words, the RfD suggests that no adverse effects are anticipated at doses at or below 2 mg/kg/day. The human data suggest that no frank adverse effects are likely at doses at or below 20 mg/kg/day.

For the acute/accidental scenarios, no exposure scenarios exceed unity. However, the exposure resulting for the consumption of contaminated water by a child, at the upper exposure estimates, approaches, but does not exceed the level of concern (HQ = 1.0). It is important to realize that the exposure scenarios involving contaminated water are somewhat arbitrary and more or less severe scenarios, all of which may be equally probable or improbable could be constructed.

The analyzed scenario is conservative in that it entails a small child (2-3 years old) drinking 1.5 liters standing water from a pond shortly after an accidental spill of a field solution of 200 gallons with no dilution or decomposition of herbicide. This is unlikely in a forested situation where flowing streams are more likely to be contaminated in a spill then a pond. The contaminated stream scenario presents more of a realistic scenario, and would result in HQ values substantially below 1. Nonetheless, this and other acute scenarios help identify the types of scenarios that are of greatest concern and may warrant the greatest steps to mitigate. For glyphosate, such scenarios involve oral (contaminated water) rather than dermal (spills or accidental spray) exposures.

The potential for a spill of herbicides into a water body is mitigated through designating routes of travel and mixing sites, minimizing herbicide mix in tanks while traveling between units, requiring a separate water truck from the batch truck, and if a spill occurs, outlining responses required by the contractor or project manager.

Triclopyr –
WORKERS – The toxicity data on triclopyr allows for separate dose-response assessments for acute and chronic exposures. For acute exposures, the hazard quotients are based on an acute NOAEL of 100 mg/kg/day from a gestational study in rats resulting in a provisional acute RfD of 1 mg/kg/day. For women of childbearing age, the acute RfD is 0.05 mg/kg/day. For chronic exposures, the hazard quotients are based on the provisional chronic RfD from U.S. EPA of 0.05 mg/kg/day.

Typical estimates of exposure for all groups of workers do not approach a level of concern. At the upper estimates of projected exposures, a hazard quotient of 1 is exceeded (HQ = 1.9). The health consequences of this exposure level are likely to vary with the duration of use. Workers who apply triclopyr only occasionally probably would not have any significant adverse effects. With sporadic uses of triclopyr, the dose can be compared against the acute RfD, resulting in HQs below unity; in other words if triclopyr is only handled sporadically, it is likely that no adv

dermal exposure scenarios and one consumption scenario for an adult female, and the dermal exposure of a child. The scenarios of an adult female from direct spray of the feet and lower legs and contact with vegetation both have an HQ of 3. The scenario of consumption of contaminated vegetation by an adult female results in an HQ of 8. Direct spray of a child results in an HQ of 1.4.

At the upper estimates of exposure hazard quotients are much higher for the previous scenarios that exceeded the level of concern with the typically application rate. Additionally the level of concern is exceeded for the scenario with consumption of contaminated fruit by an adult female (HQ = 9) and consumption of pond water contaminated in a spill, by a small child, without dilution or degradation of the herbicide (HQ = 1.2).

Again all of these exposure assessments are extremely conservative and designed to identify which possible types of exposure would be most hazardous. For triclopyr, such scenarios include dermal contact, accidental spills into water, and consumption of contaminated vegetation and fruit.

SYNERGISTIC EFFECTS

Synergistic effects (multiplicative) are those effects resulting from exposure to a combination of two or more chemicals that are greater than the sum of the effects of each chemical alone (additive). Refer to USDA, 1989 (pages 4-111 to 4-114) for a detailed discussion of synergistic effects. Instances of chemical combinations that cause synergistic effects are relatively rare. Reviews of the scientific literature on toxicological effects and toxicological interactions of agricultural chemicals indicate that exposure to a mixture of pesticides is more likely to lead to additive rather than synergistic effects (Kociba and Mullison, 1985; Crouch et al. 1983; U.S. EPA 1986).

Synergism generally has not been observed in toxicological tests involving combinations of commercial pesticides. The herbicide and additives proposed for this project have not shown synergistic effects in humans who have used them extensively in forestry and other agricultural applications. However, synergistic toxic effects of herbicide combinations, combinations of the herbicides with other pesticides such as insecticides or fertilizers, or combinations with naturally occurring chemicals in the environment are not normally studied. Based on the limited data available on pesticide combinations involving these herbicides, it is possible, but unlikely, that synergistic effects could occur as a result of exposure to the herbicides considered in this analysis.

It is not anticipated that synergistic effects would be seen with the herbicides and the adjuvant that might be added to them. Based on a review of several studies, there is no demonstrated synergistic relationship between herbicides and surfactants (Abdelghani et al, 1997; Henry et al, 1994; Lewis, 1992; Wakes and Pollak, 1999, 2000 as referenced in USDA, 2002).

However, even if synergistic or additive effects were to occur as a result of the proposed treatment, those effects are dose responsive (Dost, 1991). This means that exposure to the herbicide plus any other chemical must be significant for these types of effects to be of a biological consequence. As Dost explains:

"While there is little specific published study of forestry herbicides in this particular regard, there is a large body of research on medical drugs, from which principles arise that govern such interactions. Amplifications of effects are not massive; one chemical cannot change the impact of another by hundreds or thousands of times. Rarely would such changes be more than a few fold. This difference can be dangerous when dealing with drugs that are already at levels intended to significantly alter bodily functions, but is insignificant when both compounds are at the very

the alkylphenol ethoxylates generally have little or no effect on absorption of other compounds. In several studies, the addition of a surfactant actually decreased the absorption through the skin. It would appear that there is little to no support for the contention that the addition of surfactants to herbicide mixtures would increase the absorption through the skin of these herbicides.

There is very little information available on the interaction of glyphosate with other compounds. There is also very little information on the interactions of triclopyr with other compounds. The available data do not suggest a synergistic interaction between the triclopyr active ingredient and the other components in the commercial formulation.

SENSITIVE INDIVIDUALS

The uncertainty factor used in the development of the RfD takes into account much of the variation in human response. The uncertainty factor of 10 for sensitive subgroups is sufficient to ensure that most people would experience no toxic effects. "Sensitive" individuals are those that might respond to lower dose than average, which includes women and children. The National Academy of Sciences report entailed Pesticides in the Diets of Infants and Children (NAS, 1993) found that quantitative differences in toxicity between children and adults are usually less than a factor of approximately 10-fold. An uncertainty factor of 10 may not cover individuals that may be sensitive to herbicides, because human susceptibility to toxic substances can vary by two to three orders of magnitude. Factors affecting individual susceptibility include diet, age, heredity, pre-existing disease, and life style. Individual susceptibility to the herbicides proposed in this project cannot be specifically predicted. Unusually sensitive individuals may experience effects even when the HQ is equal or less than 1. Further information concerning risks to sensitive individuals can be found on pages 4-114 through 4-116 in USDA, 1989.

The 1996 Food Quality Protection Act requires that U.S. EPA evaluate an additional 10X safety factor, based on data uncertainty or risks to certain age/sex groupings. No reports were encountered in the glyphosate literature leading to the identification of sensitive subgroups. There is no indication that glyphosate causes sensitization or allergic responses, which does not eliminate the possibility that some individuals might be sensitive to glyphosate as well as many other chemicals (SERA, 2003a).

Because triclopyr may impair glomerular filtration, individuals with pre-existing kidney diseases are likely at increase risk. Because the chronic RfD for triclopyr is based on reproductive effects, women of child-bearing age are an obvious group at increased risk (SERA, 2003b). This group is given explicit consideration and is central to the risk characterization.

Cumulative Effects

The proposed use of herbicides could result in cumulative doses of herbicides to workers or the general public. Cumulative doses of the same herbicide result from 1) additive doses via various routes of exposure and 2) additive doses if an individual is exposed to other herbicide treatments.

Additional sources of exposure include use of herbicide on adjacent private timberlands or home use by a worker or member of the general public. Reported past use of glyphosate and triclopyr (2004-2007) in Placer County is displayed by total use and Forestland use in Table 32 below. Glyphosate is used in forestland, other crops, right-of-way, and landscape maintenance.

Triclopyr is used for right-of-way, landscape maintenance, forestland, and some other crops. We assume that there would not be any extensive changes in these use patterns into the near future.

TABLE 32 REPORTED HERBICIDE USE* IN PLACER COUNTY (2004-2007)

	Forestland Total				All Reported Uses			
Chemical	2004	2005	2006	2007	2004	2005	2006	2007
Glyphosate	6,037.2	4,395	2,794.8	2,072.7	21,787	22,664	19,234.5	19,707.2
Triclopyr	14.6	48.5	0	131.6	840.4	650	677.5	867.6

*lbs active ingredient

Additional

employment applying this fungicide can be accomplished without toxic effects. All worker occupational exposures for the typical, lower and upper application rate result in an HQ of less than 1.

While accidental exposure scenarios are not the most severe one might imagine they are representative of reasonable accidental exposures. For accidental exposure the highest hazard quotient is a factor of over 1300 below the level of concern.

The hazard quotients for general occupational exposure scenarios are somewhat higher than those for the accidental exposure scenarios. Nonetheless, the upper limit of the hazard quotient is below the level of concern (an HQ of greater than 1). As previously discussed, these upper limits of exposure are constructed using the highest anticipated application rate, the highest anticipated number of acres treated per day, and the upper limit of the occupational exposure rate. If any of these conservative assumptions were modified the hazard quotients would drop substantially. The simple verbal interpretation of this quantitative characterization of risk is that even under the most conservative set of exposure assumptions, workers would not be exposed to levels that are regarded as unacceptable.

GENERAL PUBLIC – Although Sporax is not applied in residential areas, it is applied in forested areas that may be used by members of the general public, however, because Sporax would be applied to freshly created stumps during logging of the harvest unit, and because Sporax would not be applied within the Riparian Conservation Area (RCA) buffers for tree harvest it is highly unlikely that a member of the highly

- Warming occurred in both the Northern and Southern Hemispheres and over the oceans.
- The major greenhouse gases emitted by human activities remain in the atmosphere for periods ranging from decades to centuries. It is therefore virtually certain that atmospheric concentrations of greenhouse gases will continue to rise over the next few decades.
- Increasing greenhouse gas concentrations tend to warm the planet.

According to the EPA, however, it is uncertain how much warming will occur, how fast that warming will occur, and how the warming will affect the rest of the climate system including precipitation patterns.

The Intergovernmental Panel on Climate Change (EPA, 2007) concluded that, for North American forests as a whole:

- Climate change is expected to increase the growth of forests modestly (by 10-20 percent) over the next century. However, the California Climate Change Center (2006) predict that if average state-wide temperatures increase to the medium warming range, the productivity of mixed conifer forests could be reduced by up to 18% by 2100.
- Disturbances such as wildfires and insect outbreaks are increasing and likely to intensify in a warmer climate with drier soils and longer growing seasons. The forest fire season is likely to lengthen, and the area subject to high fire danger is likely to increase significantly.
- The long-term effects of fire will depend heavily on changes in human fire management activities.

EFFECTS

Given what is and is not known about global climate change, the following discussion outlines the effects of this project on and effects of climate change on reforestation, precipitation, forest disturbance, and wildlife occupancy and use of the project area.

Reforestation: Rapid climate change over the next century would likely render many species and local varieties less genetically suited to the environment in which they are currently found. Establishing regeneration may become more difficult since seedlings are often more sensitive to environmental conditions than mature trees (Skinner, 2007).

Reforestation under Alternative 1 relies on both national regeneration and planting. Planting prescriptions specify increasing diversity of tree species within treatment units to more sustainable species including ponderosa, and sugar pine, and Douglas fir. White-fir, incense cedar and hardwoods would continue to be present and regenerate through natural regeneration. The use of seedlings grown from seed of local origin or transferred in compliance with seed transfer rules based on California Tree Seed Zones, (J. Buck et al. 1971; also refer to R-5 FSH 2409.26, Section 42.2) insures high genetic diversity of seedlings. As seedlings will be grown from seed collected from this, or adjacent seed zones, they have the potential to be of higher genetic diversity than seedlings from the immediate project area and may be better suited to the new local environment (Skinner 2007). Replanting diverse species with high genetic diversity means that, overall, reforested stands would have the potential to better adapt to changing conditions over time.

Precipitation: Variations in yearly precipitation have the potential to affect seedling survival in the short term and growth rates in the longer term. Short term droughts, which are not infrequent in the project area, reduce the total amount of soil moisture on a site. It is the soil moisture available to trees that is the limiting factor affecting seedling survival and growth. Effective control of competing vegetation during seedling establishment is the key to increasing available soil moisture to trees. The effect of drought is more likely to affect seedling survival under Alternatives 2 and 3 due to excessive moisture stress caused by reductions in available soil moisture to seedlings from competing plants.

Changing precipitation regimes in the longer term may result in changes in forest or tree productivity. The productivity of forests for timber in general is estimated to decline on a statewide basis, but some species and in some locations timber production may increase (CAT 2009), while for North America climate change is expected to increase the growth of forests modestly (by 10-20 percent) over the next century (EPA, 2007). Decreased precipitation, in the form of drought, results in higher stress levels within trees as they are not able to obtain the resources necessary for vigorous growth. Established, mature trees are often able to withstand a wide range of environmental conditions and will be able to survive for many years with effects primarily appearing as altered levels of productivity (Skinner, 2007). Once established and

free to grow, precipitation variability would likely affect tree growth rates under all alternatives more or less, equally.

Forest Disturbance and Vegetation Types: In terms of available soil moisture, the onset to spring drying and warmer growing season is expected to create greater stress for vegetation. Climate change models scaled down for California have agreed that regardless of levels of annual precipitation, warmer drier summers will result (Safford, 2010). Regional droughts may cause widespread changes to ecosystems both directly through mortality of susceptible species and indirectly by creating conditions that more readily support high intensity fires or insect outbreaks. This may cause shifts in vegetation in ecotones where vegetation is normally under some stress (Skinner, 2007). This could lead to certain species like riparian associated vegetation, within the project shrinking in distribution within the area. Direct effects of drought are usually seen in reductions in growth, but may also result in direct morality in extreme cases. Typically, however, significant changes in stand conditions and mortality occur as a result of other agents such as insects or fire, which are facilitated by the drought.

Longer annual warm periods in the area would allow some insect species to produce more broods (Skinner, 2007). In the Big Grizzly area this would likely increase the number of western pine beetle and fir engraver broods that can emerge each year. There is also potential for changes in phenology for species whose lifecycle is controlled by temperature, and changes in distribution of potential insect species and hosts, however, these sorts of changes and the effects to forest vegetation are difficult to predict. The combined effects of droughts and insects may lead to a pulse of tree mortality that increases the potential for intense fires (Skinner, 2007).

As conifer mortality increases it is likely that hardwood and shrub cover within the Big Grizzly Project Area would increase. With higher rainfall and higher nighttime minimum temperatures, broadleaf trees (especially oak species) are predicted to replace conifer-dominated forests in many parts of the low and middle elevation Sierra Nevada (Safford, 2010)

Factors which improve a stands' ability to better withstand insect and disease outbreaks include a diverse mix of species, high genetic diversity within species, vigorously growing trees, and stocking levels low enough to allow trees to have access to full site resources. Vigorous, healthy trees have a greater ability to successfully ward off insect attacks, and resist diseases. As described above, diverse mix of species, high genetic diversity within species, and vigorously growing trees would be better met under Alternative 1 than other Alternatives, because it does the most to provide for improved individual tree vigor and to promote shade intolerant pines and hardwoods while reducing the density of white fir and incense cedar on a larger portion of the landscape. Alternative 3 would leave plantation stands proposed for mastication at higher risk due to increased stress from competing vegetation, compared to the Proposed Action. Alternative 4 would be expected to produce the same effect as Alternative 1 in treated stands, but proposes to treat 913 acres fewer then the Proposed Action, and leaves these areas at higher risk as discussed in the effects sections for Alternatives above. The Non-Commercial Alternative provides some immediate benefit by reducing some competing vegetation in proposed treatment stands; however, the low intensity of thinning is not expected to produce long-term benefits to tree vigor under current climate conditions. Under projected climate scenarios it is likely that Alternative 5 would result in stands structures that are not sustainable. The No Action Alternative is believed to be the least sustainable vegetation composition and structure given its current conditions and climate change scenarios.

Given predictions for climate change and effects to forest vegetation, it may be possible to retain requirements for old forest conditions in more mesic north facing slopes, but retaining high densities of shade tolerant and intolerant trees is not expected to be sustainable on ridgetops or south and west facing slopes.

Aquatic Wildlife: Potential effects to amphibians from climate change are speculative. Generally, though, many scientists believe there would be more snowmelt runoff during spring, less water running down streams during late summer, and warmer water temperatures because of less flow. There is a point where water can be too warm for amphibians and reptiles, causing more growth of invasive algae, and magnifying disease resulting with die-offs. Ephemeral ponds may dry up sooner, and species that rely on larger perennial streams for summer aquatic habitat, would be restricted in their available habitat.

Under the No Action Alternative potential for wildfire is expected to increase. As discussed in the Aquatic Wildlife section of this chapter, high intensity wildfire in riparian areas could negatively affect amphibian populations within the project area by potentially degrading habitat or making it uninhabitable.

The activities proposed under Alternatives 1, 3, 4 and 5 are short-term and are projected to be completed within ten years. Stream buffers preserve canopy cover; however the reduction of canopy cover from fuels projects could make water temperatures slightly warmer.

Terrestrial Wildlife: The loss of riparian associated vegetation, increased gaps between habitats due to urbanization, fire and climate change, make habitat connectivity to allow adaptive migration even more important. The California State Wildlife Action Plan by UC Davis Wildlife Health Center (2007) identifies a concern for species within the Sierra Nevada from increased urbanization pressure which causes the remaining natural areas to shrink and the gaps between habitats to grow. As climate change shifts annual average temperatures along the elevation gradient, fire reshapes plant communities, and as stream flow regimes change, habitats and wildlife populations will be substantially affected. So far, very little research has evaluated the consequences of projected climate change on species at risk in the Sierra. (UC Davis Wildlife Health Center, 2007). Climate changes shifts could lead to changes in sensitive species habitat location, quality, and quantity. Much of the habitat for late seral, old forest dependent species will be even more restricted to north facing slopes and protected canyons; adding to further fragmentation of habitat.

Some species, such as Pacific fisher, that utilize high canopy, old forest hardwood/conifer habitat may find refuge in the shift from mixed conifer to hardwood/shrub, as long as other factors such as canopy cover and large downed logs are present in the landscape. Other sensitive species, such as goshawks and marten may not be able to adjust and may find their habitat more limited or shift higher in elevation. With warmer temperatures, alpine and subalpine communities are expected to shrink by 40-50% by mid-century, which will mostly impact marten and wolverine.

Most common prey species should move with shifting habitat such as rodents, reptiles and small birds. Longer annual warm periods in the area would allow some insect species to produce more broods (Skinner, 2007), effectively increasing insect prey abundance for species like woodpeckers, bats, flycatchers, and other insect eating predators. It is more likely that changes in habitat quality and quantity will influence sensitive species than changes in prey availability as a result of climate change.

In a recent review of available literature on wildlife and climate change (Joyce and Flather, 2008), the most commonly prescribed actions for reducing the impacts of climate change on natural systems are: reducing emissions, manipulating habitat, translocations, land conservation, and increasing the resiliency of natural systems via restoration. The Big Grizzly project includes three of these actions: habitat manipulation, land conservation and increased resiliency. Vegetation treatments such as those proposed in this project increase the resiliency of the current habitat within the area impacted by the Big Grizzly project for two reasons. First, they reduce the potential for stand replacing fire within treatments and over the landscape including protected sensitive species areas (PACs). Secondly they improve individual tree health by reducing competition for resources and stand health by promoting tree species that are adapted to hotter, drier summers and increased fire frequency (pines and hardwoods).

Landscape and habitat resiliency is better met under Alternative 1 than other action Alternatives due to the large area treated and the longer lasting treatment impacts. The No Action Alternative is believed to be the least sustainable to climate change in terms of vegetation composition and structure given its current conditions and climate change scenarios.

While vegetation is likely to change and shift as described, treatments may delay some of the impacts to wildlife species, especially from fire, allowing them to adjust slowly to modified or moved habitat by preserving their currently located, possibly unsustainable habitat. Experts suggest that land managers manage current habitat as reservoir until suitable habitat can be established elsewhere (Hansen et al 2001). By retaining structure and characteristics suitable to foraging and dispersal, treatment areas can still be considered suitable connective habitat to suitable high quality habitat (see specific species analysis for more detail). Because habitat for many of the late seral species is located in protected drainages, where habitat is not expected to

change, some habitat may not shift. This project and its various action alternatives would likely protect that habitat and aid the creation of future habitat in those areas.

Therefore, while climate change is a threat to many of the sensitive species within the forest boundary, this project is unlikely to add to these threats due to the benefits of protection of current and future habitat, protection of connectivity, and increases in the resiliency of the current habitat. Also, while habitat quality for some of the sensitive species is expected to decrease temporarily, the long term benefits provided by the project are in time with the expected negative impacts of climate change.

3.15 SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

The National Environmental Policy Act (NEPA) requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 Code of Federal Regulations 1502.16). For Alternatives 1, 3, 4 and Modified 1, short-term uses of the project area environment for the removal of hazardous fuels and select trees are not expected to diminish long-soil productivity and watershed function, as discussed in the Soils and Hydrology sections above. Alternative 2 reflects a substantial risk to ensuring the long-term productivity because of current risk to forest vegetation, soils and hydrology from fuel loading and fire hazard (See Soils, Hydrology, and Wildfire Behavior discussions above).

3.16 UNAVOIDABLE ADVERSE EFFECTS

Implementation of any of the alternaTT9>Tj/TT1 0 0 1 f 2.9940 0 TD 0.0006 Tc (loading)Tj/TT9 1 f 3.2395 0 Tc (nega 0.0161 Tc (t,)Tj/TTT9

3.18 CUMULATIVE EFFECTS

Cumulative effects are addressed for each resource area in the environmental consequences section.

3.19 OTHER REQUIRED DISCLOSURES

Protection of cultural resource sites would comply with the Programmatic Agreement among the USDA Forest Service, Pacific Southwest Region, California State Historic Preservation Officer, and Advisory Council on Historic Preservation Office Regarding the Identification, Evaluation, and Treatment of Historic Properties Managed by the National Forest of the Sierra Nevada, California dated 1996 (PA).

No threatened, endangered or proposed species are known to occur within the

long-term contracts provide more stability for forest workers than several short-term contracts.

Although, the Eldorado NF has no mandated, sustained yield targets, the Forest has attempted to offer about 20 million boardfeet of timber/year which is equivalent to the timber volume that the local mill has on average purchased and processed from the Eldorado NF over the last decade. Public comment and collaboration with local industry groups emphasize the contribution the proposed project makes in terms of stabilizing local timber processing infrastructure.

Analysis on direct, indirect and cumulative effects of the proposed project on human health and safety identified potential risks to human health. These risks were not generally above accepted norms. By adhering to applicable laws, regulations and policies, there would be no disproportionately high impact to low-income or minority populations as a result of project implementation.

Public involvement efforts along with issues raised by the public in relation to the implantation of this project are documented in Chapter 2 of this EIS. Scoping was conducted to elicit comments on the Proposed Action from all potentially interested and affected individuals and groups without regard to income or minority status. The Draft EIS was posted on the web at http://www.fs.fed.us/r5/eldorado/projects/biggriz/index.shtml to facilitate public review. No issues identified through public participation were identified in relation to Environmental Justice.